SOIL AND WATER RESOURCES

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SUMMARY OF CONCLUSIONS

Staff has not identified any immitigable potentially significant impacts to Soil and Water Resources for the Carrizo Energy Solar Farm (CESF) and believes the project will comply with all applicable Laws, Ordinances, Regulations and Standards (LORS) provided the proposed conditions of certification are implemented.

Staff concludes the following:

- Implementation of Best Management Practices during CESF construction and operation in accordance with effective Storm Water Pollution Prevention Plans and a Drainage Report and Sedimentation and Erosion Control Plan would avoid significant adverse effects that could otherwise result in significant transport of sediments or contaminants from the site by wind or water erosion.
- Hydrogeologic information is insufficient to determine the extent of potential impacts from CESF construction groundwater use on the local groundwater supply and neighboring groundwater users. Therefore, staff has included Conditions of Certification requiring well construction specifications, aquifer tests using the proposed pumping well and groundwater monitoring wells, monitoring of on- and off-site groundwater levels, and, if necessary, compensation of neighboring groundwater users in the event the groundwater supply is determined to be significantly impacted by construction water use. These conditions are sufficient to ensure that any significant impacts that do occur can be mitigated to a level such that they are not significant.
- Historical land and water use practices suggest the proposed operational groundwater use for the project's process and potable water needs during operation should not cause a significant adverse environmental impact or affect current or future groundwater users.
- Groundwater from the Lower Aquifer is the most degraded quality water supply reasonably available to the project, and staff considers its use by the project consistent with state water use and conservation policies.
- The proposed use of air-cooled condensers for cooling and recovery of process wastewater using Zero-Liquid-Discharge technology is consistent with state water use and conservation policies.
- The project would not be located within the 100-year flood plain, and would not exacerbate flood conditions downstream of the project.
- The proposed sanitary waste water system includes a 2,500-gallon septic tank and leach field. However, the septic tank appears to be undersized given the applicant's estimate of potable water use. Staff's proposed conditions of certification require the applicant to reconcile the difference between the estimates of potable water use in the septic tank design vs. the water supply estimates and to use a septic tank that is adequately sized.

As noted above, where potential impacts have been identified, staff proposes mitigation measures to reduce impacts to less than significant. The mitigation measures, as well as specifications for LORS conformance, are included as conditions of certification.

INTRODUCTION

This section analyzes potential impacts to soil and water resources from the construction and/or operation of the Carrizo Energy Solar Farm. The analysis specifically focuses on the potential for the project to cause impacts in the following areas:

- Whether the project's use of groundwater would substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- Whether project construction or operation will lead to degradation of surface or groundwater quality.
- Whether construction or operation will lead to accelerated wind or water erosion and sedimentation.
- Whether the project will exacerbate flood conditions in the vicinity of the project.
- Whether the project will comply with all applicable laws, ordinances, regulations and standards.

Where the potential for impacts are identified, staff has proposed mitigation measures to reduce the significance of the impact, and as appropriate, has recommended conditions of certification.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

Federal, State, and Local LORS that apply to CESF related to soil and water resources are summarized below in **Soil and Water Table 1**. Staff has reviewed the project as proposed by the applicant to determine if the proposed project will meet the requirements set forth in the Federal, State, and Local LORS.

Soil & Water Table 1
Laws, Ordinances, Regulations, and Standards

Federal LORS	
Clean Water Act (33 U.S.C. Section 1251 et seq.)	The Clean Water Act (33 USC § 1257 et seq.) requires states to set standards to protect water quality, which includes regulation of stormwater and wastewater discharges during construction and operation of a facility. California established its regulations to comply with the Clean Water Act under the Porter-Cologne Water Quality Control Act of 1967.

Resource Conservation and Recovery Act	The Resource Conservation Recovery Act (RCRA) of 1976 (42 USC§ 6901 et seq., implemented at 40 CFR Part 260 et seq.) seeks to prevent surface and groundwater contamination, sets guidelines for determining hazardous wastes, and identifies proper methods for handling and disposing of those wastes.
State LORS	
California Constitution, Article X, Section 2	This section requires that the water resources of the State be put to beneficial use to the fullest extent possible and states that the waste, unreasonable use or unreasonable method of use of water is prohibited.
The California Safe Drinking Water and Toxic Enforcement Act	This Act (California Health & Safety Code Section 25249.5 et seq.) prohibits actions contaminating drinking water with chemicals known to cause cancer or possessing reproductive toxicity. The RWQCB administers the requirements of the Act.
The Porter-Cologne Water Quality Control Act of 1967, Water Code Sec 13000 et seq.	Requires the SWRCB and the nine RWQCBs to adopt water quality criteria to protect state waters. Those regulations require that the RWQCBs issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable.
California Water Code Section 13260	Requires filing with the appropriate Regional Water Quality Control Board (RWQCB) a report of waste discharge that could affect the water quality of the state, unless the requirement is waived pursuant to Water Code section 13269.
California Water Code Section 13751	Requires that a Report of Well Completion to be filed with the Department of Water Resources within 60 days of well completion.
California Code of Regulations, Title 17	Title 17, Division 1, Chapter 5, addresses the requirements for backflow prevention and cross connections of potable and non-potable water lines.
California Code of Regulations, Title 22	Title 22, Division 4, Chapter 15, requires the California Department of Public Health (DPH) to review and approve the wastewater treatment systems to ensure they meet tertiary treatment standards allowing use of recycled water for industrial processes such as steam production and cooling water. DPH also specifies Secondary Drinking Water Standards in terms of Consumer Acceptance Contaminant Levels, including TDS ranging from a recommended level of 500 mg/l, an upper level of 1,000 mg/l and a short term level of 1,500 mg/l.
California Code of Regulations, Title 23	Title 23, Division 3, Chapter 15, requires the RWQCB to issue Waste Discharge Requirements specifying conditions for protection of water quality as applicable.
Local LORS	
San Luis Obispo County Ordinance Code, Title 15: Chapter 15,28	San Luis Obispo County requires that the Project obtain a Grading Permit that establishes grading and excavation requirements during construction of the Project.
San Luis Obispo County Code, Title 19, Building and Construction Ordinance	San Luis Obispo County requires building and construction projects adhere to requirements related to site grading (Section 19.20.040), erosion control (Section 19.20.090), and sewage disposal (Section 19.20.220).
San Luis Obispo County Ordinance Code, Title 22, Land Use Ordinance	San Luis Obispo County requires approval of a drainage plan for portions of the project that are located within an existing flood hazard zone.

State Policies and Guidance	
State Water Resources Control Board (SWRCB) Res. 77-1	State Water Resources Control Board Resolution 77-1 encourages and promotes recycled water use for non-potable purposes.
SWRCB Resolutions 75-58 and 88-63	The principal policy of the SWRCB that addresses the specific siting of energy facilities is the Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling (adopted by the Board on June 19, 1976, by Resolution 75-58). This policy states that use of fresh inland waters should only be used for power plant cooling if other sources or other methods of cooling would be environmentally undesirable or economically unsound. Resolution 75-58 defines brackish waters as "all waters with a salinity range of 1,000 to 30,000 mg/l" and fresh inland waters as those "which are suitable for use as a source of domestic, municipal, or agricultural water supply and which provide habitat for fish and wildlife". In a May 23, 2002 letter from the Chairman of the SWRCB to Energy Commission Commissioners, the principal of the policy was confirmed 'that the lowest quality cooling water reasonably available from both a technical and economic standpoint should be utilized as the source water for any evaporative cooling process utilized at these facilities'. Resolution 88-63 defines suitability of sources of drinking water. The total dissolved solids must exceed 3,000 mg/L for it not to be considered suitable, or potentially suitable, for municipal or domestic water supply.
Integrated Energy Policy Report (Public Resources Code, Div. 15, Section 25300 et seq)	In the 2003 IEPR, consistent with SWRCB Policy 75-58 and the Warren-Alquist Act, the Energy Commission adopted a policy stating they will approve the use of fresh water for cooling purposes by power plants only where alternative water supply sources and alternative cooling technologies are shown to be "environmentally undesirable" or "economically unsound." Additionally, the Energy Commission will require zero liquid discharge technologies unless such technologies are shown to be "environmentally undesirable" or "economically unsound".

REGIONAL SETTING

REGIONAL WATER RESOURCES

The proposed Carrizo Energy Solar Farm (CESF) will be located on the Carrizo Plain in an unincorporated area of eastern San Luis Obispo County. The project site is located on California State Route 58 (SR-58), approximately 36 miles east of San Luis Obispo, west of the town of Simmler and northwest of California Valley.

The Carrizo Plain watershed is located in the Central Coast Hydrologic region that encompasses about 11,300 square miles within Central California. The Carrizo Plain watershed covers an area of approximately 414 square miles (263,680 acres) bounded by coastal mountains (Figure 2-1, CESF, 2008k). The Carrizo Plain is an alluvial valley with relatively flat topography surrounded by rolling hills. The valley is approximately 56 miles long by six miles wide with the valley floor about 2,200 feet above mean sea level. East of the valley, the Temblor Range rises to elevations of about 3,000 feet, and the Caliente-San Juan Range rises to elevations 2,500 and 4,000 feet along the west side of the valley. The San Andreas Fault, running along the Temblor Range about four miles from the project site is a predominant feature in the region.

Runoff from the surrounding coastal mountains and hills flows in ephemeral drainage channels to Soda Lake. Soda Lake, within the Carrizo Plain National Monument, is approximately 10 miles downstream (southeast) of the project site. Soda Lake is a terminal lake (it does not have an outlet) and typically dries out annually except during years of unusually high precipitation. Soda Lake is an alkali lake: without an outlet, the inflow is lost to evaporation, leaving behind concentrated salts and minerals.

The natural water resources of the Carrizo Plain are extremely limited. Rainfall is the primary natural source of both surface water flows to Soda Lake and groundwater recharge for the region. However, the drainage channels within the Carrizo Plain are usually dry and flows are unpredictable and unreliable. While there are some small farm ponds on the Carrizo Plain, groundwater serves as the primary water supply for the region.

Agricultural development on the Carrizo Plain began prior to the 20th century and many ranches utilized groundwater to support irrigated agriculture throughout the 20th century. Currently, agricultural land uses are primarily centered around grazing and dry farming of wheat and barley. Irrigation wells are typically pumped for a few months to support cultivation of spring hay (CESF, 2008k). Local residents indicate that pumping for irrigation has decreased substantially over the past 40 years (CESF, 2008k).

Groundwater on the Carrizo Plain is utilized for domestic water supply, livestock, and limited irrigation. The San Luis Obispo County Master Plan Update determined that existing (1995) and projected (2020) groundwater use in the Carrizo Plain exceeded the basin yield (overdraft) estimated by DWR in 1958 (SLO, 2003). However, there are several facts that suggest the basin is not in overdraft. First, San Luis Obispo County Master Plan Update (SLO, 2003) qualified their results with several caveats: (1) the data that DWR relied upon was more than 40 years old at the time; (2) the basin has not been studied in detail, and true perennial yields are not known; and (3) much of the information does not reflect current conditions. Secondly, monitoring data from the DWR and Regional Water Quality Control Board (RWQCB) reportedly indicate that water levels tend to fluctuate in response to rainfall patterns but do not show the steady decline characteristic of overdraft conditions (CESF, 2007a). Finally, the DWR indicates that the Carrizo Plain groundwater basin is not an adjudicated basin, nor are permits required to utilize groundwater on the Carrizo Plain (CDWR, 1958). The balance between recharge and groundwater consumption is therefore unknown, and a complete determination of basin conditions is not available at this time.

Climate

While the Carrizo Plain is located within the Coastal Ranges, the climate is relatively arid with long dry summers, similar to a desert basin. Average annual precipitation on the Carrizo Plain averages between seven and nine inches per year. Nearly all of the precipitation falls during the months of November through April, although there are occasional isolated thunderstorms during the summer. Data collected through the volunteer weather station program at the Cavanaugh Ranch close to the CESF site indicates that average annual precipitation may be closer to 10 inches at the project site (CESF, 2008k). Data collected at a volunteer weather station in California Valley (#175) submitted by John Ruscovich indicates that annual rainfall near the project site averaged 10.2 inches between 1965 and 2008 and averaged 9.2 inches over the most recent 10 years (Ruscovich, 2009b). Kemnitzer (1967) estimated that an average of approximately 177,000 acre-feet per year (afy) of precipitation falls on the Carrizo Plain (8 inches rainfall per year).

During the summer, temperatures reach 90°F up to above 100°F during the day while the nights are generally cool. With the hot, dry summers, evaporation on the Carrizo Plain is considerable. Kemnitzer estimated that Evapotranspiration including vegetal uptake and soil discharge of groundwater and direct evaporation from surface waters, including Soda Lake, account for approximately 118,000 afy or about 67% of the average annual precipitation (Kemnitzer, 1967). Groundwater modeling developed by URS for the proposed project estimated that evaporation from the shallow water table removed an additional 46,300 afy of rainfall infiltration, and that total evaporation losses accounted for about 93% of average precipitation (CESF, 2009g).

Groundwater

The CESF lies within the Carrizo Plain Groundwater Basin, with approximately 270 square miles of contributing area that ultimately drains to Soda Lake (Figure 3-4, CESF, 2008k). Similar to the surface watershed, the Carrizo Plain Groundwater Basin is bounded by the Temblor Range to the east and the Caliente Range and San Juan Hills to the west. The San Andreas Fault running along the Temblor Range in a southeast-northwest direction is the dominant geologic feature in the Carrizo Plain forming the northeast boundary of the Carrizo Plain Groundwater Basin. To the west and southwest, the San Juan, Big Spring, and Morales faults run along the Caliente Range and San Juan Hills. The Temblor and Caliente Ranges are comprised of sandstone, shale, conglomerate, and siltst one that overlie an older granitic complex.

In the Carrizo Plain, groundwater is found in alluvium and the Paso Robles and Morales Formations. The alluvium is highly variable, consisting of unconsolidated to loosely consolidated sands, gravels, and silts with some layers of compacted clays. In the vicinity of the project site, the alluvium consists of primarily clay and clayey sands to a depth of about 100 feet. Underlying the alluvium, the Paso Robles Formation consists of poorly sorted, loosely consolidated gravels, sands, and silts. The Paso Robles formation is up to 3,000 feet thick near the San Andreas Fault. Along the western portion of the Carrizo Plain Groundwater Basin, where the Paso Robles formation is thinnest, groundwater yields may be better than areas closer to the San Andreas Fault (Kemnitzer, 1967). The lower portion of the Paso Robles Formation is comprised of fine-grained clays that limit mixing between the better quality groundwater in the Paso Robles Formation and the lower quality groundwater in the underlying Morales Formation. The Morales Formation consists of sands, gravels, and silts ranging in thickness from just a few feet to more than 3,000 feet.

Groundwater near the project site is generally supplied from Upper and Lower Aquifer zones. The Upper Aquifer is generally less than 300 feet below ground surface (bgs) and the Lower Aquifer is at a depth of 450 to 600 feet bgs (CESF, 2008k); the Upper and Lower aquifers are separated by fine textured silt and clay beds. The Upper Aquifer provides the potable water supply to most residences and ranches on the Carrizo Plain (Kemnitzer, 1967). Domestic wells tend to be relatively shallow, less than 175 feet bgs, and yield up to about 40 gpm (CESF, 2008k). The Upper Aquifer consists of clays and sandy clays with thin layers of sand that comprise the water bearing strata (CESF, 2008k). There is considerable variability throughout the Upper Aquifer and many residents have noted problems with limited water availability (CESF, 2008k). Since the permeable sand layers are relatively thin, additional pumping from the Upper Aquifer can result in lower water levels and decreased well yields (CESF, 2008k).

The Lower Aquifer is generally greater than 450 feet bgs and is within the Paso Robles Formation. Wells within the Lower Aquifer can yield as much as 500 to 1,100 gpm (Kemnitzer, 1967). Wells that penetrate the Lower Aquifer provide irrigation water supply and community water supply. Well logs suggest that the Lower Aquifer is a confined to semi-confined aquifer, separated from the Upper Aquifer by relatively impermeable clay layers (Bechtel, 1984).

The groundwater with the poorest water quality is located in the alluvium near Soda Lake (Kemnitzer, 1967). Since Soda Lake is the termination for all surface flows in the Carrizo Plain Watershed, evaporation of freshwater results in mineralization of the groundwater at the lake. Groundwater elevation contours reported by Kemnitzer (1967) for water levels in the alluvium and Upper Aquifer (“Soda Lake and Carrizo groundwater bodies”) indicated horizontal gradients are towards Soda Lake, suggesting groundwater discharge to the lake bed and surrounding soils. Groundwater quality tends to improve further from Soda Lake. Near the project site, the Upper Aquifer produces groundwater with somewhat better quality than the Lower Aquifer.

The DWR estimated that the storage capacity of the Carrizo Plain groundwater basin is about 400,000 acre-feet (CDWR, 1958). In 1958, the DWR utilized land use to estimate annual pumping from the Carrizo Plain at 600 afy. No downward trends in groundwater elevations were observed during the investigation, and DWR assumed that estimated consumptive use (600 afy) represented the safe yield for the Carrizo Plain (DWR, 1958). Later In 1967, Kemnitzer estimated that about 534 afy was pumped from the Carrizo Plain for domestic and livestock uses, and about 4,205 afy was pumped for irrigation (total annual extraction rate of 4,739 afy). Although Kemnitzer’s (1967) estimated pumping rate was almost eight times greater than DWR’s 1958 estimate, he reported that groundwater level fluctuations were still only seasonal, and the long-term balance between recharge and discharge was stable. Most recently, the San Luis Obispo County Master Water Plan update (2001) for Water Planning Area #8 (California Valley) estimated current (1995) annual pumping from the Carrizo Plain to be about 930 afy.

Kemnitzer (1967) estimated that average annual recharge of the groundwater basin was approximately 59,000 afy or about 33% of the average annual precipitation on the Carrizo Plain. The rest of the precipitation is assumed lost to evaporation. Kemnitzer (1967) reported Upper Aquifer groundwater elevations indicating discharge to the lake bed. In the Lower Aquifer, Kemnitzer (1967) concluded most of the annual recharge discharges into the adjacent La Yeguas and San Juan subsurface drainage areas located north of the Carrizo Plain. However, Kemnitzer (1967) did not provide observed Lower Aquifer groundwater level data to support the assumed northwestward flow, but instead inferred the structure of the water-bearing formations beneath the plain and concluded this controlled flow of the residual in his estimated water balance.

Groundwater-flow modeling completed by the project applicant included evaporation from the shallow water table (evaporation from a water table within 15 feet of land surface). The model simulates annual net recharge (the difference between rainfall infiltration and simulated evaporation from the water table), and results indicate net recharge is 14,324 afy (about 8% of average annual precipitation), which is significantly lower than Kenmitzer's (1967) estimated recharge rate (CESF, 2009g). For comparison, groundwater recharge estimated independently by staff using the Maxey-Eakin method indicated average annual recharge rates ranging from about 12,000 to 19,000 afy, which generally agree with net recharge simulated by the groundwater-flow model.

PROJECT, SITE AND VICINITY DESCRIPTION

The proposed Carrizo Energy Solar Farm (CESF) is a 177 MW solar thermal power plant. The proposed project site is located on the Carrizo Plain in an unincorporated area of eastern San Luis Obispo County on Section 28, Township 29 South, Range 18 East, on the California Valley and La Panza NE United States Geological Survey 7.5 minute quadrangle maps (Figure 1.1-3, CESF, 2007a). The CESF is located on California State Route 58 (SR-58), approximately 36 miles east of San Luis Obispo, west of the town of Simmler and northwest of California Valley. The CESF includes 195 Compact Linear Fresnel Reflector (CLFR) solar concentrating lines and associated heat transfer equipment on a 640-acre site. The 640-acre site would be graded to form terraces for the CLFR solar concentrating lines (Figure 1.2-6, CESF, 2008h). A 380-acre construction laydown area is located south of SR-58 on Section 33. The total area occupied by the project and laydown area is approximately 1,020 acres (1.6 square miles).

The CESF is located in an area zoned for agricultural use in the San Luis Obispo County General Plan. Electrical generation is a permitted land use within an agricultural zone in the San Luis Obispo County Land Use Ordinance. The area surrounding the CESF is primarily open, undeveloped land utilized for dry farming, grazing, and rural residential land uses. The Carrisa Plains School is located approximately one mile south of the CESF site on the southwest corner of Section 34. Several existing residences are located within 1 mile of the project site, including residences located directly adjacent to the northern and western boundaries of the project site.

The CESF site is located adjacent to Pacific Gas and Electric's (PG&E) Morro Bay-Midway 230 kilovolt (KV) and 115 KV transmission lines. PG&E's Carrizo Plain Substation is approximately 98 feet east of the northeast corner of the project site, and the Morro Bay-Midway transmission lines are located approximately 98 feet north of the project site. The CESF project includes an electrical transmission system that will require approximately 850 feet of 230kV transmission line, of which about 90 feet is outside of the project site boundary.

The CESF is estimated to require approximately 20.8 afy of groundwater for process water, collector mirror washing, potable water, service water, and fire protection (CESF, 2008k). Groundwater would be pumped from an onsite well that extends into the Lower Aquifer. Groundwater would be treated with softeners, demineralization, and sanitizing equipment. Process wastewater would be recycled back into the water treatment system to minimize water demand. Sanitary wastewater would be discharged to an onsite septic system and leach field. Construction of the CESF is estimated to also require a maximum of 144 afy, which would also be supplied by groundwater.

Soils

The CESF project site, laydown area, and transmission line corridor are located on areas mapped by the USGS as agricultural land used primarily for dry farming or for grazing.

The soils at the proposed CESF site consist of deep, well-drained soils on alluvial deposits. Surface soils consist of fine-grained clay and silt loam, with a substratum of clay enriched soils (CESF, 2007a). The primary soil types located at the proposed project site and laydown area are listed below in **Soil & Water Table 2**. Additional soil characteristic data can be found in Tables 5.4-1 and 5.4-2 and Figure 5.4-1of the Application for Certification (AFC) (CESF, 2007a).

Soil & Water Table 2
Primary Soil Types Potentially Affected & Characteristics

Primary Soil Name	Slope Class	Water Erosion Potential	Wind Erosion Potential	Permeability	Land Capability Class
Yeguas-Pinspring Complex	0 to 5 %	Moderate	Moderate	Moderately slow, and slow	IV (non-irrigated) II (irrigated)
Thomhill Loam	2 to 5 %	Moderate	Moderate	Moderately slow	IV (non-irrigated) II (irrigated)

CESF, 2007a, Section 5.4.1.1

The soils at the proposed CESF site and laydown area are within the Yeguas-Pinspring Complex. These soils are identified as Class IV (non-prime) when not irrigated and Class II (prime) when irrigated. However, given the limited water resources available on the Carrizo Plain, the potential for irrigation at the project site is limited and dry land farming of grains may result in low yields and grazing capacity may be diminished (SLO County, 2008c). In general, soils of the project have low permeability and moderate water erosion potential. The fine-grained soils have a moderate wind erosion potential. The applicant proposes to apply groundwater during construction as the primary BMP to limit wind erosion.

The proposed project includes grading to create 17 terraces for the power block and solar field. Grading involves a balanced cut and fill of about 1,200,000 cubic yards (cy) of material. The Solar Field terraces will be laid out in four rows of four terraces with an additional terrace for the power block in the central portion of the northern part of the site (Figure 1.2-6, CESF, 2008h). Grading will be performed in phases limited to one or two terraces at a time. Clearing and grading will occur during the first six months of construction. The earthwork will utilize standard construction equipment including dozers, scrapers, excavators, loaders, compacting rollers, and dump trucks. Groundwater will be used during construction for moisture conditioning and dust control during grading. The applicant estimates that about 144 acre feet will be used during the first year of construction.

Soil and Groundwater Contamination

The proposed CESF site and laydown area have been used primarily for agricultural/ dry farming activities. A Phase I Environmental Site Assessment (ESA) was performed for the proposed project site including a site reconnaissance conducted in June 2007 (CESF, 2007a).

The Phase I ESA indicated that a 2,000-gallon diesel underground storage tank was removed from Section 27 next to the proposed CESF site in 1994. Soil sampling following tank removal did not indicate residual contamination. At the proposed CESF site, several storage drums (with unknown contents) were noted. However, the drums did not appear to be leaking, and therefore, were not considered a recognized environmental condition in the Phase I ESA (CESF, 2007a). In addition, several above ground storage tanks including a 500-gallon fuel storage tank, a 1,500-gallon fuel storage tank, and a fuel pump were located on the laydown area parcel. All of the tanks were empty during the June 2007 reconnaissance (CESF, 2007a).

The Phase I ESA did not identify any recognized environmental conditions at the proposed CESF site or laydown area. However, communications with longtime resident, John Ruscovich, indicate that there may have been a fuel storage tank on the proposed CESF site (Ruscovich, 2008a); this fuel tank was not identified in the Phase I ESA. Existing drums and any remaining storage tanks will be identified and disposed of as hazardous materials as required under RCRA. See the **Waste Management** Section for further discussion of potential soil and groundwater contamination and conditions of certification proposed for mitigation of any potential impacts due to environmental conditions.

Stormwater

The CESF site is located on the Carrizo Plain and receives an average annual rainfall between seven and nine inches per year (CESF, 2007a). The project includes grading to terrace the 640-acre project site and minor grading within the 380-acre laydown area. The finished project would occupy 640 acres including about 13 acres for the generating equipment at the Power Block and about 627 acres for the Solar Field terraces and perimeter swales.

Carriza Creek is the main stormwater drainage feature on the Carrizo Plain in the vicinity of the proposed CESF site. Carriza Creek conveys runoff from the northern portion of the Carrizo Plain to Soda Lake. It flows from the northwest to the southeast across the southeast corner of the laydown area (Figure 1.1-3, CESF, 2007a). The Federal Emergency Management Agency (FEMA)'s Flood Insurance Rate Map (FIRM) for the Carrizo Plain indicates that portions of the CESF site near Tracy Lane and portions of the laydown area along Carriza Creek are within the FEMA designated 100-year 'Zone A' floodplain areas (Figure 5.5-1, CESF, 2007a).

Currently, runoff from two up-gradient watersheds with a contributing area of about 8.2 square miles flows onto the northern portion of the proposed CESF project site in two drainage swales (Figure 2-2, CESF, 2008k). On the proposed CESF project site, these up-gradient swales become less distinct and visible possibly due to the disturbed nature of the existing agricultural site. Runoff from the proposed CESF site and the up-gradient watersheds sheet flows to the southwest across the site and across SR-58 until it drains into the Carriza Creek in the laydown area.

During construction, the Solar Field terraces would be graded to create localized detention/infiltration areas in the center of each terrace. San Luis Obispo County standards require that projects that develop between one and four square miles limit post- construction peak flow rates to below existing peak flowrates for a 50-year design storm (SLO County, 2007). The detention/infiltration area in each Solar Field terrace is designed to contain the stormwater runoff generated in a 50-year, 10-hour (approximately 4-inches) storm event. Following construction, the runoff peak flow rate and volume discharged from the CESF project site will be less than under existing conditions, which meets San Luis Obispo County standards. Stormwater runoff will be detained within the detention/ infiltration areas until it is infiltrated into the subsurface and evaporated. Detaining and infiltrating stormwater runoff from small frequent storms with Low Impact Design (LID) approaches including detention/infiltration areas is a goal of hydrograph modification requirements currently being developed by San Luis Obispo County.

Offsite runoff generated in the 8.2 square mile upgradient watersheds would be routed in perimeter swales around the Solar Field (DESCP Figure 6, CESF, 2008h). Current design plans indicate that flows in the perimeter swale would be routed across SR-58 allowing runoff to sheet flow across the laydown site south to the Carriza Creek. Along the northern boundary of the proposed CESF site, the perimeter swale has been designed to convey a 5- to 10-year peak discharge. Excess flows from the offsite watersheds that cannot be conveyed in the perimeter swale would sheet flow across the Solar Field terraces and be captured in the detention/infiltration areas. Along the western and eastern boundaries of the proposed CESF site, the perimeter swales have been designed to convey storm flows from a 100-year peak discharge. Runoff in the perimeter swales will be routed across SR-58 either in culverts or the swales will be graded to match existing grades along SR-58 allowing runoff to cross the highway as sheet flow to match the current conditions (CESF, 2009g).

Within the laydown area, there are two permanent drainage crossings proposed for Carriza Creek (CESF, 2008p). Each of these proposed crossings include three 3 x 5 feet box culverts with velocity dissipation at the outlets (CESF, 2009g). The crossings are required to facilitate access by providing a turnaround for large trucks. At the crossing locations the existing Carriza Creek channel is 14 to 18 feet wide and about two feet deep (CESF, 2008p). The three box culverts are sized to convey a 2-year to 5-year peak flow on the Carriza Creek without overtopping the upstream creek banks (DESCP, CESF, 2008h). The project will need to submit a Stream Alteration Notification to the California Department of Fish and Game (CDFG), which will then provide its recommendations to the Energy Commission regarding any requirements that would be associated with the crossing pursuant to Fish and Game Code, section 1602.

Following construction, all non-contact runoff generated in the Power Block area will be directed via grading and swales towards the detention/infiltration areas in the Solar Field terraces. Contact runoff generated in vehicle parking and paved areas will be directed to an oil-water separator (OWS) for treatment prior to discharge to the raw water treatment system (described below). Contact runoff from active areas (in the vicinity of oil-filled transformers and hazardous material storage) that may be contaminated by oil will also be routed to the OWS.

Project Water Supply

Water will be required for dust control, moisture conditioning (for compaction), concrete, potable water and other uses during construction of the CESF. The annual volume of water supply for each of the three years of construction is estimated as follows:

Year 1 - 144 acre feet;

Year 2 - 72 acre feet; and

Year 3 - 38 acre feet (CESF, 2009g).

During operation, water will be required for:

- Make up water for the solar thermal and steam turbine system
- Washing of solar reflectors and collectors
- Potable water
- Service water for general site uses including dust control and irrigation
- Fire protection

Untreated raw water will be supplied during both construction and operation by groundwater pumped from an existing well located near the center of the CESF project site on Section 28. The existing well is approximately 630 feet deep with a 16-inch diameter steel casing and screen (CESF, 2009g). The existing well would be fitted with a 75 hp, (500 gpm) submersible pump to extract groundwater from the Lower Aquifer. Raw water would be pumped to a combination raw water/firewater storage tank.

The CESF is estimated to require about 20.8 afy of groundwater during operation. The expected average daily water use is approximately 18,500 gpd. The peak daily water use is approximately 74,000 gpd, which is expected to occur one day per year to clean the air-cooled condensers. Water usage rates are summarized below in **Soil & Water Table 3.**

Soil & Water Table 3
Carrizo Energy Solar Farm Water Usage Rates

Water Use	Average Annual (gpm)	Average Daily (gpm)	Maximum Daily (gpm)
Process Water[1]	28.4	27.6	51.0
Recovered Water[2]	28.4	27.6	51.0
Reflector Wash Water	5	7	13
Air Cooled Condenser Wash Water	0.25	0.25	32
Potable Water	5.3	5.3	5.3
Net Raw Water Use	**10.6**	**12.6**	**50.3**

CESF, 2008k, Section 1.2.2, Table 1-1
[1] Process water includes Steam Cycle Makeup, Media Filter Backwash, and miscellaneous drainages to the OWS.
[2] Recovered water includes Steam Drum Flash Steam, Blowdown Flash Tank Condensate, and OWS recovery.

Raw water will be pumped from the raw water storage tank to an onsite water treatment system. The water treatment system includes:

- Water softening to remove calcium carbonate and sodium carbonate. Softened water will be used for reflector cleaning.
- Demineralization in a cartridge mixed bed ion exchange system to remove suspended and dissolved solids. De-ionized water will be used as makeup water for steam drums.
- Injection of an anti-corrosive agent, a DEHA (diethyl hydroxyl amine) compound (Corrotrol) corrosion inhibitor. Condensate and feedwater circulating in the steam field will be treated with Corrotrol.
- Potable water for personnel use will be supplied with de-ionized water pumped to a potable water skid that includes sanitizing equipment and pumps for distribution and pressurization.

Virtually all of the process water will be captured, routed through the water treatment system, and reused. The net water use for CESF is primarily for potable uses, reflector wash water, and air-cooled condenser wash water.

The 450,000 gallon raw water/firewater storage tank has sufficient capacity to provide for two days of full load operation under the maximum daily water use while maintaining 300,000 gallons of capacity for firewater storage. In the event that the water delivery and treatment system is temporarily unable to supply CESF with sufficient water, water will be transported from San Luis Obispo, Paso Robles or other regionally-available water supplies. Two tanker trucks per day would be required to supply back-up water in the event of an interruption in the water supply system.

Process and Sanitary Wastewater

The applicant proposes two wastewater collection systems for the CESF, which will separate process wastewater from sanitary wastewater. The process wastewater system would collect all process wastewater streams from operation of the plant and deliver it to the zero liquid discharge (ZLD) system. All process wastewater including blow down from the steam turbine will be recovered, recycled through the water treatment system, and returned to the demineralizer as a makeup supply. Water from impervious surfaces in the Power Block and hazardous materials storage areas will be collected in the oil water separator and routed to the water treatment system for reuse. No wastewater would be discharged to surface waters (CESF, 2007a). Waste streams from the water treatment system will include spent resin cartridges from the demineralization process.

Other streams of wastewater include:

- Washdown water for the solar reflectors and collectors, which will evaporate off of the reflectors and collectors.
- Washdown water from the air-cooled condenser, which will evaporate (it is not clear from the materials submitted to date how the ACC washdown water will be collected for evaporation).

- Media filter backwash, which will be used for dust control.

The CESF will utilize a sanitary system consisting of a buried 2,500 gallon septic tank and leach field for all sanitary wastewater streams including toilets, sinks, and showers (CESF, 2007a). The septic system will be designed to meet San Luis Obispo County standards.

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

This section provides an evaluation of the expected direct, indirect and cumulative impacts to soil and water resources caused by construction, operation and maintenance of the project. Staff's analysis of potential impacts consists of a brief description of the potential effect, an analysis of the relevant facts, and application of the threshold criteria for significance to the facts. If mitigation is warranted, staff provides a summary of the applicant's proposed mitigation and a discussion of the adequacy of the proposed mitigation. If necessary, staff presents additional or alternative mitigation measures and refers to specific conditions of certification related to a potential impact and the required mitigation measures. Mitigation is designed to reduce potentially significant project impacts to a level that is less than significant.

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

Potential impacts including depletion of local/regional water supplies, placement of fill in existing channels, and soil erosion are among those staff examined to determine potentially significant impacts associated with the proposed project. Overall, staff evaluates if the project can be built and operated without violating erosion, sedimentation, flood, surface or groundwater quality, water supply, or wastewater discharge standards. There are extensive regulatory programs in effect that are designed to prevent or minimize these types of impacts through the implementation of Best Management Practices. Our experience with these programs has demonstrated that they are effective. Therefore, absent unusual circumstances, we conclude that the threshold of significance for these potential impacts is based upon the ability of an applicant to identify and implement Best Management Practices (BMPs) and to prevent erosion or contamination to a level where these impacts will be less than significant.

Soils

Soils can be adequately protected by development and implementation of a proper Drainage Report and Sediment and Erosion Control Plan (DRSECP) to meet the Energy Commission's and San Luis Obispo County's requirements and a Storm Water Pollution Prevention Plan (SWPPP) to meet the State Water Resources Control Board's requirements as applicable for both construction and operational phases of the project. The LORS and Policies presented in **Soil & Water Table 1** were used to determine the threshold of significance of project impacts for this proceeding.

Water

Staff also evaluated the potential of the project's proposed water use to cause or contribute to:

- Substantial depletion of groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- Substantial depletion or degradation of local or regional surface water supplies, including fresh water runoff delivered to Soda Lake via the Carriza Creek.
- Substantial degradation of local groundwater quality.

Well Interference

All use of wells within a groundwater basin contributes toward a lowering of water levels at other well locations. The overlap of drawdown among two or more wells is called "well interference", and is considered significant when it results in a loss of yield or exposes the well screen. A loss of yield is appreciable if the project well renders an existing nearby well incapable of meeting 1) maximum daily demand, 2) dry-season demand, or 3) annual demand. Exposure of the neighboring well screen represents potential for physical damage to the well.

Table 3-1 in "Hydrology and Hydrogeology Report for the Vicinity of the Proposed Carrizo Energy Solar Farm" (Carrizo Energy, LLC, 2009) summarizes well completion data obtained from wells near the proposed project site. These data show wells less than 300 feet deep, which staff assumed to be constructed within the Upper Aquifer, have on average a reported depth to water that is 35 feet below land surface. Similarly, the average depth from land surface to the top of the Upper Aquifer well screens is 70 feet, and the bottom of the wells average 170 feet below land surface. Hence, the top of the screened interval is on average submerged 35 feet below the water table. The reported pumping rates range from 8 to 300 gpm, and average 66 gpm.

Assuming unconfined groundwater conditions, the theoretical relationship between groundwater elevations, aquifer conductivity, well diameter, and discharge at a steady rate Q is described by Equation (1):

$$Q = \pi K (H^2 - h^2) / \ln(R/r) \quad (1)$$

where:

Q is the constant well discharge rate, in ft^3/day;
K is the hydraulic conductivity of the aquifer, in ft/day;
H is the groundwater elevation at a distance R from the well, both in ft;
h is the groundwater elevation in the well, in ft;
r is the radius of the well, in ft; and,
π is a constant and equal to the ratio of a circle's circumference to diameter (approximately 3.1416).

Equation (1) assumes (a) groundwater is unconfined; (b) the aquifer is horizontal, infinite and of constant thickness; (c) the water bearing materials are homogeneous and isotropic; and, (d) the groundwater elevation is everywhere uniform prior to pumping (Driscoll, 1995).

Equation (1) indicates the theoretical discharge rate is determined primarily by the hydraulic conductivity and groundwater elevations, and owing to the logarithmic function in the denominator much less on the distance “R” and well diameter “r”. Employing Equation (1) for a specified well-groundwater system (i.e., fixed hydraulic conductivity, well diameter, and groundwater elevation in the well) the proportional change in discharge can be calculated Equation (2).

$$(Q_1 – Q_2) / Q_1 = (H_1^2 - H_2^2) / (H_1^2 – h^2) \qquad (2)$$

where:

> Q_1 and Q_2 are constant well discharge rates corresponding to groundwater elevations H_1 and H_2; and,
> h was defined previously for Equation (1) and is assumed the same for both pumping rates.

Equation (2) indicates the relative or percent change in well discharge is directly related to the difference in drawdown caused by the pumping. The conductivity, well radius, and distance R are all constant for a given well and therefore cancel each other in the calculation.

Well interference from project pumping occurs when groundwater levels around existing wells decrease, thereby reducing maximum theoretical well yield. The maximum theoretical well yield can be defined as the pumping rate supplied by a well without lowering the water level in the well below the pump intake (Freeze & Cherry, 1979). Typically, pump intakes are located near the top of the screened interval because it is desirable to keep the screen submerged under water; submerging the well screen can minimize chemical clogging and physical deterioration of the well screen (Driscoll, 1995). We therefore assumed the change in maximum theoretical well yield is represented by the change in static (non-pumping) water level between the aquifer and the top of the well screen.

For the average well construction and water table depth, the relationship between groundwater elevation drawdown and maximum well yield was calculated using Equation (2) and results summarized below.

Relationship between drawdown at the well and maximum theoretical well yield.

Water level drawdown (ft)	Reduction in maximum theoretical well yield (percent)
1	3%
3	10%
5	16%
10	32%
20	61%
30	88%

Project pumping can impact existing wells by lowering groundwater levels and reducing yields. For example, a drawdown of three feet reduces the average theoretical well yield by 10%. The lower well yield can increase pumping cost, decrease discharge pressure, and increase pump operating time. The impact becomes significant when drawdown is large enough to expose the well screen, or the well no longer meets the water demand of its intended use.

The San Luis Obispo County Master Water Plan update (2001) estimates rural indoor water use at one-third of an acre-foot per year, and outdoor water use by rural dwellings (ranchettes) range from 0.5 to 3.0 acre-feet per year (average water use of 1.7 acre-feet per year by rural dwellings). However, staff observed limited water use associated with lawns, gardens, and agriculture by most residents of the Carrizo plain and estimated average water use substantially less than 1.7 acre-feet per year and likely closer to the lower limit of 0.5 acre-feet per year. Hence, staff believes that operational well yields are typically closer to 0.5 afy (~0.3 gpm).

The pumping rates for Upper Aquifer wells reported in Table 3-1 range from 8 to 300 gpm (average pumping rate of 66 gpm), and all are more than sufficient to meet the estimated annual water requirement of typical rural dwellings in the Carrizo plain (CESF, 2009g). For most wells the key constraint is to ensure well interferences do not expose the well screen, which on average is approximately 35 feet below the water table. However, the production rates of lower yielding wells may be significantly impacted before the well screen is exposed. For example, 5 feet of drawdown at an 8 gpm producing well can reduce its maximum yield by 1.3 gpm (16%), which conceivably could significantly impact the owner's ability to use the well. The magnitude and extent of the impact would depend on the specific water use, season, required flow rate and duration, and the size of any on-site storage capacity. This information is obtained by identifying potentially impacted wells, inspecting well conditions, documenting well production rates, and completing owner surveys to record water use requirements.

Quality of Water Produced

In the Carizzo plain, limited water quality data suggest the Upper Aquifer has better water quality than the Lower Aquifer. Historical water quality for the period 1965-1977 indicated an average Total Dissolved Solids (TDS) concentration of about 750 mg/L in water produced by an on-site Upper Aquifer well; no recent data was reported for the well. Results for a 1968 sample from a deeper but now abandoned on-site well indicated a higher TDS concentration of 957 mg/L, and recent results from a similarly deep well (the proposed project pumping well) indicated a TDS concentration of 1,140 mg/L. The deeper well extracts water from both the Upper and Lower aquifers, and the higher TDS concentration is presumably due to the contribution of lower quality, high TDS water from the Lower Aquifer.

The water quality data set indicates nitrate (NO_3) concentrations in the Upper Aquifer are substantially greater than in water from the Lower Aquifer. The average 1965-1977 NO_3 concentration in samples from the Upper Aquifer was about 90 mg/L, which is nine times greater than the maximum contaminant level (MCL) of 10 mg/L. In contrast, the two water samples from deeper on-site wells were 2.3 and 13 mg/L, respectively. Upper

Aquifer groundwater is more susceptible to land use activities than the Lower Aquifer, and the greater Upper Aquifer nitrate concentrations may indicate past influences from fertilizer use, septic systems, or other anthropogenic activities.

Project pumping can reduce Lower Aquifer water levels, which conceivably can increase Upper Aquifer leakage into the Lower Aquifer. This process is not expected to influence Upper Aquifer TDS concentrations, and therefore not expected to impact the quality of the primary residential water supply aquifer. Significant leakage from the Upper Aquifer would likely dilute and reduce Lower Aquifer TDS concentrations, but could increase NO_3 loads to the Lower Aquifer. The downward movement of these constituents, if any, would likely be delayed significantly by the fine-grained silt and clay deposits between the Upper and Lower Aquifer.

DIRECT/INDIRECT IMPACTS AND MITIGATION

The direct and indirect impact and mitigation discussion presented below is divided into a discussion of impacts related to construction, operation, and water supply (for both construction and operation). For each potential impact evaluation, staff briefly describes the potential effect and applies the threshold criteria for significance to its analysis. If mitigation is warranted, staff provides a summary of the applicant's proposed mitigation and a discussion of the adequacy of the proposed mitigation. In the absence of an applicant-proposed mitigation or if mitigation proposed by the applicant is inadequate, staff mitigation measures are recommended. Staff also provides specific conditions of certification related to a potential impact and the required mitigation measures.

Construction Impacts and Mitigation

Construction of the CESF will include soil excavation, grading, installation of utility connections and the use of water, primarily for dust suppression, moisture conditioning, and concrete mixing. Potential impacts to soils related to increased erosion or release of hazardous materials are possible during construction. In addition, fertile topsoil in the laydown area may be impacted by over-compaction, which could limit future agricultural productivity. Potential stormwater impacts could result if increases in runoff flow rate and volume discharged from the site were to increase flooding downstream. Water quality could be impacted by the discharge of eroded sediments from the site or hazardous materials released during construction. Project water demand could affect quantity of groundwater or surface water resources. Potential construction related impacts to soil, stormwater, and water quality or quantity, including the applicant's and staff's proposed mitigation measures are discussed below.

Soil Erosion Potential

Construction activities can lead to adverse impacts to soil resources including increased soil erosion, soil compaction, loss of soil productivity, and disturbance of soils crucial for supporting vegetation. Activities that expose and disturb the ground surface leave soil particles vulnerable to detachment by wind and water. Soil erosion could result in the loss of topsoil and increased sediment loading to nearby receiving waters including the Carriza Creek and Soda Lake.

The magnitude, extent and duration of those impacts would depend on several factors, including the proximity of the CESF site to surface water, the type of soils affected, and the method, duration, and time of year of construction activities. Prolonged periods of precipitation, or high intensity and short duration runoff events coupled with earth disturbance activities can result in on-site erosion. In addition, high winds during grading and excavation activities can result in wind borne erosion leading to increased particulate emissions that adversely impact air quality. The implementation of appropriate erosion control measures will help conserve soil resources, maintain water quality, prevent accelerated soil loss, and protect air quality (DESCP, CESF, 2008h). In the **Air Quality Section**, proposed conditions of certification **AQ-SC3 and AQ-SC4** provide mitigation that will prevent significant impacts from fugitive dust and wind borne soil erosion by requiring dust control to disturbed lands during construction.

Construction of the proposed CESF facility would disturb two areas that total about 1,020 acres. In the absence of proper BMPs and due to the soil type, the project earthwork could cause significant fugitive dust and erosion. In reference to **Soil & Water Table 2**, the predominant surface soil classifications on the proposed CESF site are fine-grained clay and silt loam which have a moderate wind and water erosion potential (CESF, 2007a and SLO, 2008c).

Water and Wind Erosion

The CESF project site will be subject to wind and water erosion during construction and operation. Project construction is planned over a 35-month period (CESF, 2007a, Section 3.4.13). Grading activities are expected to occur during the first six months of construction. The total earth movement will be significant, including approximately 1.2 million cubic yards of material. The earthwork will consist of primarily cut and fill grading of 640 acres for the Solar Field terraces and Power Block with excavation for foundations and underground systems (CESF, 2007a, Section 3.4.13). Several factors contribute to the significant potential for water and wind erosion effects, including the high volume of earth displacement, a long duration for construction, and soil properties that have a moderate susceptibility for wind and water erosion. The applicant has proposed the following erosion control measures: scheduling to minimize disturbed areas exposed during the rainy season; preservation of existing vegetation; use of drainage swales, ditches, and earthen berms; use of velocity dissipation devices and outlet protection; use of erosion control mats or blankets; and streambank stabilization (DESCP, CESF, 2008h). The applicant has proposed the following sediment control measures: use of silt fences, straw bales, check dams, and/or fiber rolls; use of sediment traps; stabilized construction entrance/exits; stabilized construction roadways; and street sweeping and vacuuming (DESCP, CESF, 2008h). Wind erosion will be controlled through the use of watering or other dust palliatives; controlling speeds on construction roadways; and limiting the surface area disturbed (DESCP, CESF, 2008h). These wind erosion control measures will also limit the potential for Valley Fever (discussed below) to impact workers and neighbors. Following construction, the applicant proposes the use of hydroseeding and/or hydraulic mulch to stabilize the Solar Field terraces and laydown area to control erosion (CESF, 2008w).

The general sequence for implementing BMPs would be to install a silt fence around the perimeter of the entire project area and along the perimeter of sub-section plots according to the phases of grading. Construction would begin in the Power Block area, followed by sections of the Solar Field terraces. Each Solar Field terrace includes a detention/infiltration area sized to detain runoff generated by a 50-year, 10-hour rainfall event that will also serve as a sediment trap. During construction (and operation), trapped sediments will need to be removed from the detention/infiltration areas to maintain infiltration rates and storage volume as needed. In addition, the perimeter swales will be graded to route offsite runoff around the Power Block and Solar Field terraces. The perimeter swales will be protected against erosion during construction with check dams. The Carriza Creek will be protected with a silt fence or similar sediment control barrier. During grading work, soil would be stabilized by maintaining sufficient water content to make it resistant to weathering and erosion by wind and water.

The applicant has prepared a draft Drainage Erosion and Sediment Control Plan (DESCP) which is the Energy Commission's equivalent to the Drainage Report and Sediment and Erosion Control Plan (DRSECP) required by San Luis Obispo County. The draft DESCP provided conceptual plans for erosion and drainage control measures during the construction phase of CESF (CESF, 2008h). Staff believes the plan is reasonable and the sequence for implementing BMPs will avoid significant adverse impacts due to erosion. Condition of Certification **SOIL&WATER-2** would require the applicant to prepare a final DRSECP for both construction and operations, to assure these BMPs are implemented, to address maintenance of the detention/ infiltration areas, and to identify post-construction BMPs to stabilize the Solar Field terraces and laydown area. Similar to the DRSECP and in accordance with federal law, the RWQCB specifies that the applicant is to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for construction activity required under Condition of Certification **SOIL&WATER-1**. In addition, the applicant would be required to comply with applicable grading requirements identified in the **Facility Design** section of this FSA.

Valley Fever

The Carrizo Plain has been identified as an area that may be impacted by Coccidioides (cocci) the fungal agent that causes Valley Fever. Valley Fever has caused flu-like symptoms in construction workers exposed to dust that contains cocci spores. The California Department of Public Health recommends that construction projects in San Luis Obispo County:

1. Update the project's Injury and Illness Prevention Program to include safeguards against Valley Fever.

2. Provide training to help workers understand the causes and symptoms of Valley Fever.

3. Control dust exposure to workers while digging and grading through standard dust control BMPs and personal protective equipment.

4. Prevent transport of soils that may be contaminated by cocci spores, and

5. Provide medical surveillance for construction workers to monitor, identify, and treat incidence of Valley Fever.

In addition to Conditions of Certification **SOIL&WATER-1** and **-2**, Condition of Certification **AQ-SC3** and **AQ-SC4** in the **Air Quality** section of the PSA require that CESF develop and implement a plan to control fugitive dust and monitor conditions in the interest of minimizing the potential for Valley Fever to construction workers and neighboring residents. Staff is recommending that dust control BMPs include soil wetting during rough grading and application of dust palliatives, soil binders and soil weighting agents as appropriate following rough grading. All dust control palliatives, soil binders, and soil weighting agents shall be identified in the DRESCP and approved by the CPM in accordance with Condition of Certification **SOIL&WATER-2**.

Staff believes that through the proper application of BMPs, the impact to soil resources from water and wind erosion during construction will be reduced to a level that is less than significant.

Soil and Groundwater Contamination

The Phase I ESA did not identify any Recognized Environmental Conditions at the proposed CESF site or laydown area (CESF, 2007a). However, the Phase I ESA did identify a number of fuel storage tanks and drums onsite. Based on the presence of fuel storage tanks and drums on the CESF site and laydown areas, the applicant recognizes the potential for excavation of contaminated soils at the project site. The applicant indicates that any contaminated soils encountered will be separated, stored temporarily onsite, and ultimately removed for disposal or treatment and recycling (CESF, 2007a). Management of contaminated soils (if encountered) will be conducted in accordance with applicable federal, state, and local regulations as required by conditions of certification included in the **Waste Management** section of this PSA.

During construction, there is the potential for hazardous chemicals to be released from construction equipment or materials storage areas. The applicant will provide details related to hazardous materials storage areas and construction vehicle fueling and maintenance areas in the Construction SWPPP required in Condition of Certification **SOIL&WATER-1.** The vehicle fueling area will include 1,000-gallon gasoline and diesel storage tanks within a secondary containment area. A refueling truck equipped with spill prevention and cleanup equipment will refuel vehicles that cannot traverse to the refueling area.

The applicant provided a preliminary spill response plan in Section 3.4.8.1 of the AFC (CESF, 2007a). Spill cleanup equipment including empty drums, absorbent pads and oil absorbent will be maintained near fueling areas and hazardous materials areas to respond in the event of a spill. All construction personnel will be trained in handling hazardous materials. The project will employ an onsite health and safety person, who will be responsible for implementing health and safety guidelines and notifying emergency response personnel in the event of a spill.

Staff believes that these measures will be effective in preventing soil and groundwater contamination and no potentially adverse impacts associated with soil and groundwater contamination will be caused by construction of the proposed CESF project.

Laydown Area Agricultural Productivity

The 380-acre construction laydown area contains agriculturally productive topsoil (Class II when irrigated). The laydown area will be utilized for materials storage, onsite manufacturing, site offices, and collector assembly, as well as, vehicle parking, turnaround and fueling during construction. Following construction, the applicant proposes to remove all buildings and return the area to its pre-construction condition.

However, concrete building pads or gravel access roads can result in over-compaction of the existing topsoil impacting future agricultural productivity. Placement of gravel on existing topsoil can affect the texture and productivity of the soils. In areas where construction materials will be stockpiled, manufactured, or assembled, commingling or contamination of the underlying topsoil with construction materials could result in significant adverse impacts to the suitability of the soil for agriculture.

To avoid these potentially significant impacts, staff recommends that the applicant implement the following measures to protect and restore the agricultural capability of the existing top soil:

1. In any area where a foundation or concrete pad is proposed, the topsoil (soil horizon A) should be removed and stockpiled for the duration of the use of the laydown area. The stockpiled soil should be protected from erosion and restored at the conclusion of facility construction.

2. In any area where gravel will be utilized, an underlayment of durable, geotextile matting should be placed over the native topsoil prior to the placement of gravel/base material.

3. In any area where construction materials will be stockpiled, manufactured or assembled, a similar geotextile matting should be utilized to prevent comingling or contamination of the native topsoil with construction materials.

4. All construction materials, concrete, road base, and geotextile matting should be removed upon completion of the project.

5. The entire construction laydown area should be restored to its pre-construction texture, available water holding capacity, soil permeability, and organic matter content. Post restoration, actual crop productivity should be equivalent to the existing pre-construction productivity.

6. All disturbed areas within the construction laydown area shall be seeded with a seed mix consisting of drought-tolerant grasses native to the Carrizo Plain. The seeded areas shall be monitored for vegetation establishment and reseeded and/or reworked as necessary to develop vegetated coverage on the laydown area.

These measures should be included in the final DRSECP prepared in accordance with Condition of Certification **SOIL&WATER-2,** which requires the applicant to identify post-construction BMPs to stabilize the Solar Field terraces and laydown area.

Stormwater

Potentially significant water quality impacts could occur during construction, excavation, and grading activities if contaminated soil or other hazardous materials used during construction were to contact stormwater runoff and drain off-site. Water quality could also be adversely impacted if the stormwater drainage pattern concentrates runoff in areas that are not properly protected with BMPs causing erosion of soils and discharge of sediment into down-gradient surface waters. Flooding downstream of the project site could also increase if peak runoff flow rates discharged from the CESF project site increase.

The CESF is located in an undeveloped area utilized for dry farming, grazing and rural residential land uses. The project site is primarily disturbed ranchland. Currently, stormwater infiltrates into the soil, evaporates, or flows across SR-58 into Carriza Creek. There are two small drainage channels that drain up-gradient watersheds of approximately 8.2 square miles that flow onto the CESF site. Several factors contribute to the significant potential for stormwater erosion effects, including the high volume of earth displacement, the large area that will be disturbed, a long duration for construction, and site soil properties that have a moderate potential for water erosion.

The grading at CESF incorporates perimeter swales to route up-gradient runoff around the project site to the southwest corner of the site where the runoff will overtop SR-58 and sheet flow to Carriza Creek as currently occurs. The perimeter swales will be protected against erosion during construction using check dams constructed of hay bales (DESCP, CESF, 2008h). To limit the potential for significant erosion and water quality impacts, the perimeter swales must be in-place prior to the onset of the first rainy season during construction. The perimeter swales will also serve as a sediment trap to capture eroded sediments discharged from the project site or up-gradient of the project site resulting in improved water quality down-gradient.

Grading would begin in the Power Block area, followed by sections of the Solar Field terraces. Each Solar Field terrace includes a detention/infiltration area sized to detain runoff generated by a 50-year, 10-hour rainfall event that will also serve as a sediment trap. The detention/infiltration areas capture runoff from each Solar Field terrace and non-contact runoff from the Power Block allowing the runoff to infiltrate to recharge the Upper Aquifer. These detention/infiltration areas will limit runoff discharged (peak flow rates and volumes) from the project site to below existing runoff discharge. This drainage approach addresses both potential impacts to surface water quality and potential increases in downstream flooding. During construction, the capacity of the detention/infiltration areas will need to be maintained by removing trapped sediment as needed.

In the construction laydown area, the applicant has proposed two permanent crossings of the Carriza Creek to facilitate access to the proposed fueling station. Each proposed crossing consists of three 3x5-feet box culverts and an access road crossing the Carriza Creek. At the crossing locations the existing Carriza Creek channel is 14 to 18 feet wide and about two feet deep (CESF, 2008p). The three box culverts are sized to convey between a 2-year and 5-year peak flow on the Carriza Creek without overtopping the upstream creek banks. The applicant proposes to install velocity dissipation at the outlets of the culverts to limit erosion at the culvert outfalls (DESCP, CESF, 2008h).

These culverts and the access roads crossing the Carriza Creek in two locations represent fill in an existing creek channel, which could result in a potentially significant impact to the main drainage channel on the Carrizo Plain in the vicinity of the project site. The applicant has determined that the Carriza Creek below the ordinary highwater mark (OHWM) is a jurisdictional water of the U.S. The U.S. Army Corps of Engineers (ACOE) has issued a Preliminary Jurisdictional Determination for Carriza Creek.

Placing culverts and fill to create two permanent crossings of a jurisdictional channel to facilitate a truck turn-around in the laydown area could result in significant impacts to wildlife that utilize the Carriza Creek for habitat and migration pathways. In addition, placement of fill in the Carriza Creek channel could increase flooding upstream of the crossings resulting in a potentially significant impact. The culverts could also be subject to debris blockage during high flow events.

The applicant provided a conceptual HEC-RAS model in the revised hydrology report (CESF, 2009g) that indicates that flood elevations up-gradient of the crossings would not significantly increase during 2-year and 100-year design discharges. In addition, the applicant has committed to revise the HEC-RAS model during final design to reflect surveyed cross-sections of the existing drainage channel, and if necessary update the crossing design to ensure that flood elevations upstream of the crossings are not increased. Staff requests that the updated HEC-RAS modeling examine a wider range of design discharges including the 2-, 5-, 10-, 25-, 50- and 100-year discharges. The applicant has already proposed use of velocity dissipation BMPs at the culvert outfalls to limit potential erosion impacts to a less than significant level.

CDFG has indicated that they would prefer that CESF reconfigure the laydown area to avoid the need for stream crossings. Alternatively, CDFG indicated that use of temporary structures to span the small creek channel would be preferable to avoid permanent impacts to Carriza Creek. Staff concurs with the CDFG and recommends that the applicant reconsider the design of the Carriza Creek crossings to use temporary structures that span the creek channel to avoid or minimize fill within the OHWM as required in Condition of Certification **SOIL&WATER-2.** While the Carriza Creek crossings can be designed to limit erosion impacts at the outfalls through the use of velocity dissipation BMPs and flooding impacts upstream of the crossings through the use of adequately sized culverts, the placement of permanent fill in an existing creek to facilitate truck turnaround should be avoided or minimized if possible.

Staff believes that the two crossings of Carriza Creek can be accomplished with less disturbance to the stream by installation of bridges rather than culverts. The bridges will still require footings and likely placement of fill within the OHWM, but the extent of fill and disturbance will be minimized. The placement of fill in an existing creek channel within the OHWM triggers several regulatory requirements:

- The applicant will need to obtain a Clean Water Act Nationwide 404 Permit from the USACOE. The 404 permit is currently waiting on a Section 7 Consultation from the US Fish and Wildlife Service (USFWS) as required in Condition of Certification **BIO-16**.

- The applicant will need to satisfy the permit requirements of the Clean Water Act 401 Water Quality Certification from the Central Coast RWQCB as required in Condition of Certification **BIO-14**.
- The applicant will need to submit a Stream Alteration Notification to the California Department of Fish and Game (CDFG), which will provide its recommendations regarding any requirements that would be associated with the crossing pursuant to Fish and Game Code, section 1602 as required in Condition of Certification **BIO-13**.
- The applicant will need to develop a design that spans the creek and minimizes fill placed in the creek, and in doing so, will need to demonstrate that the crossing of Carriza Creek will not increase existing flood elevations upstream of the crossings as required in Condition of Certification **SOIL&WATER-2**.

The applicant prepared a draft DESCP in response to staff's comments, providing conceptual plans for erosion and drainage control measures during the construction and operation phases of the CESF. Staff has reviewed the DESCP and believes that the applicant has identified a reasonable conceptual level BMP plan that will avoid significant adverse impacts to stormwater drainage and water quality. Condition of Certification **SOIL&WATER-2** would require the applicant to prepare a Final DRSECP for both construction and operations, to assure these BMPs are implemented, including the detention/infiltration areas for the Solar Field, and demonstrate that the proposed Carriza Creek crossings will not increase flooding upstream of the crossings. Similar to the Energy Commission's and San Luis Obispo County's requirements to prepare a DRSECP, the State Water Resources Control Board (SWRCB), in implementing federal law, requires the applicant to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for construction activity; this is reflected in Condition of Certification **SOIL&WATER 1**.

Staff believes that through the proper application of BMPs, including the detention/ infiltration areas in the Solar Field terraces for trapping sediment and attenuating stormwater runoff equal to or below pre-developed rates, the impact to soil and water resources from stormwater drainage during construction will be reduced to a less than significant level. Provided the applicant meets the requirements for a 404 Permit, 401 Certification, and Streambed Alteration Agreement, and utilizes culverts or spans that do not increase upstream water levels, potentially significant stormwater related impacts associated with the Carriza Creek crossings can be mitigated to less than significant levels.

Construction Water Supply

Groundwater pumped from the Lower Aquifer via an onsite well will be used to meet construction water demand. The applicant estimates that construction water demand during the 3-year construction phase of the project will range from a maximum of 144 afy during the first year of construction down to 72 afy and 38 afy during the second and third years of construction (CESF, 2009g). This estimate includes about 11 acre feet for concrete mixing, about 69 afy for dust suppression and about 72 acre feet for moisture conditioning and compaction during grading activities (CESF, 2009g).

Potable water demands during construction will be minimal. The applicant has not yet identified a separate supply of drinking water for the construction workforce. Staff assumes that bottled water will be used to supply drinking water for the construction workforce. Sanitary facilities would consist of portable toilets and would operate without water.

Potential impacts to groundwater resources associated with groundwater withdrawal for construction and operations water supply are discussed in the separate section "Water Supply Impacts and Mitigation".

Groundwater – Dewatering

Groundwater levels on the Carrizo Plain are a minimum of about 14 feet bgs and are about 30 feet bgs at the CESF site. The deepest excavations are anticipated to be about eight feet bgs for trenching and foundations at the Power Block and about three feet bgs at the Solar Field terraces. Thus, the applicant does not anticipate encountering groundwater in excavations during construction. However, if groundwater is encountered and dewatering is required, the applicant will employ dewatering BMPs as detailed by the standard California Department of Transportation (BMP NS-2) and incorporated into the DRESCP. Any groundwater encountered would be sampled. Provided the groundwater is free of contaminants, the groundwater may be used for dust suppression or other onsite non-potable water requirements.

Staff agrees that the likelihood of encountering significant groundwater during construction is remote. Based on the applicant's proposed dewatering operations that would be available if needed, no impacts to groundwater resources are expected to occur as a result of dewatering during construction of the CESF.

Wastewater

The applicant estimates that approximately 237,755 gallons of raw water (groundwater) will be used for hydrostatic testing of pipelines and pressure vessels four times during construction. This water will be returned to the raw water storage tank for reuse following testing. Thus, water utilized for hydrostatic testing will not be discharged during construction. Sanitary wastes from portable toilets will be pumped to a tanker truck and disposed offsite.

Improper handling or containment of construction wastewater could cause a broader dispersion of contaminants to soil, groundwater or surface water. During construction, wastewater would be managed with BMPs identified and implemented in accordance with the construction SWPPP required by the Central Coast RWQCB, consistent with Condition of Certification **SOIL&WATER-1** and the DRESCP consistent with Condition of Certification **SOIL&WATER-2**. Staff concludes that no significant impact from construction wastewater will occur provided that all construction wastewater is handled in accordance with BMPs described in the project's construction SWPPP and DRESCP.

Operation Impacts and Mitigation

Operation of the CESF could lead to potential impacts to soil, stormwater runoff, water quality, and water supply. Soils may be potentially impacted through erosion or the release of hazardous materials used in the operation of the CESF. Stormwater runoff from the CESF could result in potential impacts if increased runoff flow rates and volumes discharged from the CESF site increase downstream flooding. Water quality could be impacted by discharge of eroded sediments from the CESF or hazardous materials released during operation. Water supply for plant processes, fire protection, potable uses, and landscape irrigation could lead to potential impacts to quantity or quality of regional groundwater or surface water resources. Potential impacts to soil, stormwater, water quality, water supply, and wastewater related to the operation of the CESF, including the applicant's proposed mitigation measures and staff's proposed mitigation measures, are discussed below.

Soil

The applicant has proposed hydroseeding and/or hydraulic mulch to stabilize soils and control erosion in the solar field terraces and laydown area. The applicant indicates that the laydown area will be cleared of all construction materials and the top soil will be disked and tilled to return the area to its existing condition. Measures required to protect and restore the agricultural productivity of the soils in the laydown area are described in detail in the construction section.

Within the Solar Field, reflector mirrors and collectors will be washed on a rotating basis resulting in a nearly continuous washing operation during the night. The applicant anticipates washing 20 collector lines per day, requiring about 530 gallons per line (CESF, 2008a). The applicant plans to use softened water with a mild bio-degradable detergent (CESF, 2008a). The wash water will be sprayed on the collectors and cleared off the surface with a squeegee. While the wash water is expected to primarily evaporate, some will deposit on the soil surface. The softened water is expected to have sodium concentrations of about 290 mg/l, nearly double the existing groundwater concentration of about 150 mg/l (CESF, 2008a). The minor amount of wash water applied, less than 0.2 inches per unit area per year, will not result in a significant accumulation in sodium concentrations in soils and will not affect soil salinity or plant toxicity. The Central Coast RWQCB advised staff that they would not issue specific waste discharge requirements for mirror and collector wash water.

For the portion of the solar field exposed to routine vehicular traffic such as roads used for mirror washing between rows of solar collector mirrors, staff recommends that soil be stabilized using a soil-weighting agent that absorbs into the soil particles to increase their weight and to prevent fugitive dust. Based on manufacturer's recommended maintenance frequencies, it is likely that soil stabilization using the soil binding and weighting agents will need follow-up treatment annually and biannually, respectively. Conditions of Certification **SOIL&WATER-2 and -3** will require the implementation and maintenance of drainage and erosion control measures according to plans as specified in the DRSECP and Industrial SWPPP. In addition, Air Quality Condition of Certification AQ-SC7 would minimize dust related to project operations by requiring the applicant to develop and implement dust and erosion control procedures. With the BMPs detailed in the required plans implemented and maintained, staff does not believe there would be significant impacts to soil resources during operation of CESF.

Stormwater

Staff examined several potential impacts related to stormwater. Staff verified that stormwater discharge rates from the CESF site would not exceed pre-development rates. Staff also examined the applicant's proposed drainage plans to determine if the total runoff delivered to the Carriza Creek and ultimately Soda Lake would be significantly altered. In addition, staff reviewed the applicant's conceptual plans for controlling drainage to assure that appropriate BMPs are identified to avoid degradation of water quality from erosion or contact with contaminants.

Without mitigation, runoff from the CESF site would exceed pre-development runoff due to the increase of impervious areas at the Power Block and for foundations for the collectors and mirrors in the Solar Field. The applicant has included detention/ infiltration areas within each Solar Field terrace sized to capture all runoff generated during a 50-year, 10-hour rainfall event. In total, the applicant estimates that the 16 detention/infiltration areas will be able to capture up to 590 acre-feet of rainfall/runoff (CESF, 2008h). These detention/infiltration areas will reduce runoff discharge flowrates and volumes to below pre-development rates in accordance with the San Luis Obispo County standards (SLO County, 2007d).

Given the clay nature of the soil, infiltration rates are likely to be relatively low (0.25 to 1 inches/day). Without proper infiltration BMPs such as infiltration trenches, the lowest portions of these areas could maintain shallow pools that last for several weeks following a typical rainfall event. These areas are likely to clog with fine-grained material sealing the ground surface, further reducing infiltration and increasing the duration of ponding after rainfall events. This could result in increased mosquito breeding and become an issue for maintenance at the site. To avoid potentially significant vector control impacts, the applicant has committed to incorporate standard infiltration BMPs such as infiltration trenches in the lowest portions of the detention/ infiltration areas to allow the water quality volume (80% capture volume, CASQA, 2003) to drain within three to five days accounting for infiltration and average evaporation rates during the rainy season. These infiltration BMPs generally incorporate gravel fill to depths of four to six feet penetrating the existing clay layers in the upper four feet of the soils at the site allowing stormwater runoff to percolate into the more permeable sandy loam layers below. These infiltration BMPs should be maintained annually (or as needed) to maintain sufficient infiltration rates.

In the proposed drainage plans, up-gradient runoff will be captured in perimeter swales, routed around the Solar Field and Power Block and discharged across SR-58 to the Carriza Creek. The applicant has committed to design the perimeter swales such that there will be positive drainage across SR-58 without significant detention within the swales. The applicant plans to either include small culvert(s) across SR-58 to allow for drainage of the swales or to grade the swales to match the existing topography along SR-58 to allow runoff to cross the highway as it does in the existing conditions. This approach will limit changes in runoff delivery to Carriza Creek from the proposed project.

Staff also examined the potential for proposed stormwater management plans for CESF to significantly alter the delivery of runoff to Soda Lake. Following construction, stormwater runoff generated at the project site will be captured in detention/ infiltration areas and allowed to percolate into the subsurface with infiltration BMPs. This approach would reduce surface runoff delivered to Carriza Creek and ultimately Soda Lake. To estimate the potential impact capturing project site runoff would have on flows in Carriza Creek, staff examined 2-year, 6-hour and 24-hour events. The 2-year return period event is a relatively significant storm event that occurs once every one to two years on average; the vast majority of rainfall events are smaller than the 2-year event. Staff utilized the runoff volume estimates that the applicant provided from HEC-HMS computer model simulations for pre- and post-project conditions (CESF, 2009g). The drainage areas are shown on Figure 2-2 in the applicant's Hydrology and Hydro-geology Report (CESF, 2009g). The results of staff's analysis are summarized below in **Soil & Water Table 4**.

Staff's analysis for the 2-year, 6-hour and 24-hour events indicates that the total runoff volume delivered to Carriza Creek at the downstream limit of the laydown area decreases by about 10 acre-feet (2.6%) and 35 acre-feet (2.4%) due to the volume of runoff captured in the Solar Field detention/infiltration areas. Runoff is dependant on contributing area, and the project site represents about 2.4% of the watershed contributing runoff to Carriza Creek. Thus, the decrease in runoff delivered to Carriza Creek for the smaller rainfall events that typically fall on the Carrizo Plain would be relatively similar.

Soil & Water Table 4
Carrizo Energy Solar Farm Stormwater Discharge

Location	Basin Area (square miles)	2-year, 6-hour Runoff Volume (acre-feet)	2-year, 24-hour Runoff Volume (acre-feet)
Basin 1 (Carriza Creek)	31.6	293	1,099
Basin 2 (up-gradient)	3.9	36	136
Basin 3 (up-gradient)	4.3	40	149
CESF Site (pre-project)	1.6	15	56
CESF Site (post-project)	1.6	31	85
Total @ Laydown (pre-project)	41.3	382	1436
Total @ Laydown (post-project)	40.3	372	1401
Decrease in Runoff Volume	**---**	**10**	**35**

CESF, 2008k, Appendix B

Staff also considered the total change in runoff delivered to Soda Lake. At staff's request, the applicant developed HEC-HMS simulations for the entire Soda Lake watershed under the existing pre-project and post-project scenarios (CESF, 2009g). For the 2-year 6-hour event, total runoff delivered to Soda Lake is estimated to decrease from about 3,833 acre-feet pre-project to about 3,824 acre-feet, or about 0.24%. Similarly, in a 2-year, 24-hour event, total runoff delivered to Soda Lake decreases by about 0.24% from 14,396 acre-feet to 14,361 acre-feet. Since the one square mile project site represents 0.24% of the 413.5 square mile Soda Lake watershed, and runoff is highly dependant on contributing area, staff concurs with the applicant's estimates of change in runoff delivery to Soda Lake. A change in runoff delivery of 0.24% is not expected to result in significant impacts to the hydrology of Soda Lake including water depths, water quality, and duration of ponding.

These estimates of the change in runoff delivery to Soda Lake likely represent an estimate of the maximum potential impact. Runoff that is infiltrated at the project site will tend to increase Upper Aquifer groundwater levels. In addition, as discussed below in staff's analysis of potential groundwater impacts, the change in land use including covering the majority of the site in mirrors to collect solar energy is likely to significantly decrease evapo-transpiration at the project site resulting in an increase in Upper Aquifer groundwater levels. These changes are likely to increase groundwater gradients and flow towards Carriza Creek and Soda Lake. As groundwater levels at the project site increase, the gradient (i.e. slope) that drives groundwater flows towards Soda Lake is expected to increase. This increased gradient results in increased delivery of groundwater towards Soda Lake. At Soda Lake, percolation of surface water is dependant on the gradient (or head difference) between surface water levels and surrounding groundwater levels. As groundwater delivery towards Soda Lake is increased, groundwater levels increase, and percolation of surface waters at Soda Lake would be expected to decrease.

Staff has also reviewed the applicant's conceptual Best Management Plans (BMPs) for controlling stormwater drainage to assure that appropriate erosion control and drainage measures are identified to avoid degradation of water quality from water coming into contact with either soil or hazardous materials. Contact runoff from the Power Block area including runoff from vehicle parking areas, paved areas, and active areas that may potentially be contaminated with oil will be captured, routed to an oil water separator, and ultimately to the water treatment system for use as process water. Non-contact areas of the Power Block (where there is no potential for contamination from hazardous materials) would be graded to drain to a detention/infiltration area in the Solar Field. Secondary containment structures would be built around the oil-filled equipment and hazardous materials areas to prevent dispersion in case of a spill. Solid wastes and small amounts of hazardous waste that are generated would be properly accounted for, tracked, handled, and disposed of off-site using licensed transporters and disposal facilities. Conditions of Certification **SOIL&WATER-2 and -3** require the project owner to prepare plans for implementing, monitoring and maintaining BMPs appropriate for the operating phase in the form of a DRSECP and SWPPP for Industrial activity. The goal of the DRSECP is to identify any potential sources of contaminants that could be present during project operations, assure adequate BMPs are incorporated into the project's final design, and implemented for preventing pollution of soil and water resources. Compliance with Conditions of Certifications **SOIL&WATER-2 and -3** will ensure there are no significant impacts or conveyance of pollutants to Carriza Creek or to other soil and water resources including Soda Lake.

Flooding

The CESF project site is located adjacent to the FEMA 100-year floodplain along Carriza Creek. CESF will employ detention/infiltration areas that will encourage infiltration and will attenuate any discharges so that they do not exceed the pre-developed runoff rates. Therefore, flooding downstream of the project site will not be increased as a result of the project.

However, as discussed above in Construction Stormwater Impacts, the applicant proposes two permanent crossings of the Carriza Creek in the laydown area to facilitate truck turnaround. The proposed crossings each utilize three 3x5-feet box culverts within the existing Carriza Creek channel. Based on preliminary HEC-RAS modeling presented by the applicant, the crossings can pass the 2-year and 100-year design discharges without significantly increasing upgradient flood elevations. The applicant has committed to survey the existing drainage channel, revise the HEC-RAS model during final design to reflect the surveyed cross-sections, and if necessary update the crossing design to ensure that flood elevations upstream of the crossings are not increased. Staff requests that the updated HEC-RAS modeling examine a wider range of design discharges including the 2-, 10-, 25-, 50- and 100-year discharges. The applicant has already proposed use of velocity dissipation BMPs at the culvert outfalls to limit potential erosion impacts to a less than significant level.

While staff would recommend that the applicant reconsider the need for the creek crossings to avoid potential impacts to an existing creek channel, the crossings can be designed to limit the potential for upstream flooding and downstream erosion. Compliance with Condition of Certifications **Soil and Water-2** and **BIO-13, 14, and 16** will ensure that significant stormwater related impacts associated with the Carriza Creek crossings can be mitigated to less than significant levels.

Wastewater

The applicant proposes two separate wastewater collection systems for CESF. The process wastewater system will collect all wastewater generated from the operation of the plant and return it to the plant's water treatment system. The water treatment system includes mixed bed ion exchange demineralization system. The ion exchange system removes solids from the process water into ion exchange resin cartridges, which will be taken offsite for regeneration by a contract service (CESF, 2007a). Plant drainage including leakage and drainage from facility containment areas would be collected in a system of floor drains, sumps, and pipes within the CESF Power Block and discharged to an oil/water separator (CESF, 2008a). Following treatment in the oil/water separator, the contact wastewater would be routed to the water treatment system for reuse. No significant soil or water related impacts are expected if project owner meets the requirements of Condition of Certification **Soil & Water-4** that requires CESF to treat all process wastewater with a Zero Liquid Discharge (ZLD) system in accordance with a ZLD management plan.

Sanitary wastewater will be routed to a 2,500-gallon onsite septic tank and leach field for all sanitary wastes from toilets, sinks, and showers. The applicant indicates that the septic tank and leach field will be designed according to San Luis Obispo County regulations and standards to avoid potential groundwater impacts. Staff has reviewed the septic tank sizing based on the standards provided in the California Plumbing Code (CPC, 2007). The applicant presented design calculations indicating that the proposed septic tank can treat the wastewater generated by the 75 employees planned for the plant. However, the flow rates utilized to size the septic tank average about 1.2 gpm on an annual 24-hour basis. Using the applicant's estimate of 5.3 gpm of potable water supply, CPC standards indicate that the project would require a 6,850 gallon septic tank. It is possible that the average annual potable water use would be less than 5.3 gpm averaged over 8,760 hours. The applicant should revisit the estimates of potable water demand and septic system sizing to ensure that the septic system design is in accordance with San Luis Obispo County and CPC standards. No significant soil or water related impacts are expected if the project owner constructs and operates the proposed septic and leach system in accordance with the provisions of a Septic Facility Permit from San Luis Obispo County as required in Condition of Certification **Soil & Water-5.**

Water Supply Impacts and Mitigation

Construction Water Supply

Groundwater pumped from the Lower Aquifer via an onsite well will be used to meet construction water demand. The applicant estimates that construction water demand during the 3-year construction phase of the project will range from a maximum of 144 acre feet during the first year of construction down to 72 acre feet and 38 acre feet during the second and third years of construction (CESF, 2009g). This estimate includes about 11 acre feet for concrete mixing, about 69 acre feet for dust suppression and about 72 acre feet for moisture conditioning and compaction during grading activities (CESF, 2009g).

The applicant's water use estimates assume that as earthwork is completed in various areas, means of dust control other than water will be employed. The applicant has proposed the use dust palliatives or other alternative measures including the use of soil binders and weighting agents following the completion of earthwork in discrete areas to limit the use of water for dust suppression. In addition, following completion of earthwork, hydroseeding and hydro-mulching may be utilized to re-establish vegetation and stabilize disturbed areas. Staff recommends that the applicant utilize CPM approved dust palliatives and other dust control BMPs including soil binders, weighting agents, hydroseeding, and hydro-mulch, to minimize water use during construction to the extent possible.

Project Operations Water Supply

The applicant has proposed to use up to 20.8 afy of groundwater for project operations including process water and potable water. If groundwater from the on-site well were temporarily interrupted, back up water would be trucked in to the CESF from San Luis Obispo, Paso Robles or other regionally-available water supplies. CESF would require two tanker trucks per day to maintain normal operational water supply.

Groundwater is the only source of process and potable water feasible for CESF. Given the rural, agricultural nature of the Carrizo Plain area, there is no wastewater treatment plant in the vicinity of the project site to potentially supply recycled water. There is limited irrigated agriculture on the Carrizo Plain, and agricultural wastewater is not available. Groundwater below the project site is located in two aquifers, the Upper Aquifer – characterized by relatively high water quality but lower yields, and the Lower Aquifer – characterized by relatively lower water quality and higher yields. The applicant proposes to utilize lower quality groundwater from the relatively more productive Lower Aquifer, thereby targeting the lowest quality water reasonably available for the project's process and potable uses.

The CESF is designed as a dry cooled facility to minimize water usage requirements during operations. Dry cooling is a more expensive process that uses up to 40 times less water than a more conventional wet cooled facility. The estimated water supply requirements for CESF operations (0.12 afy/MW) are relatively low as compared to other power generating facilities (CESF, 2008k). The National Renewable Energy Laboratory estimates that a conventional wet cooled parabolic trough solar plant requires between 21 to 27 afy/MW and a dry cooled parabolic trough solar plant requires about 2.2 afy/MW (CESF, 2009g). The recently licensed Victorville 2 hybrid plant included a natural gas fired combined cycle facility with a 250-acre solar-thermal system, which requires about 5.6 afy/MW. Thus, CESF's water use requirements are only two to 5% of the water use at other comparable power generating facilities.

The operational water use at CESF represents about 5% of the average annual rainfall on the 640-acre project site. As compared to other water uses on the Carrizo Plain, the CESF's water requirements are relatively similar. If the 640-acre site were subdivided into sixteen 40-acre residential plots, those single family residences would require about 8 to 24 afy of groundwater or about 38 to 115% of the groundwater use at CESF. The proposed water use at CESF could irrigate about 33 acres of the 640-acre CESF site for barley production, a crop with very low water requirements. At least 400 afy (about 19 times the proposed water use at CESF) of groundwater would be required if the entire 640-area site were irrigated for barley production.

Based on communications with Sandra Rowlett, whose great-great-grandparents homesteaded the CESF site in 1858, the project site historically supported irrigated agriculture (Rowlett, 2009). In the 1970's the project site supported 100 acres of alfalfa grown for seed that was flood irrigated with the proposed pumping well. In the 1980s, Dole leased the same 100 acres and used the proposed pumping well to aggressively irrigate carrots (Rowlett, 2009). These land uses would require up to 400 afy of irrigation.

The project's potential impacts to groundwater supplies and quality are discussed below.

Groundwater

The applicant plans to pump groundwater for construction and all process and potable uses during the operation of CESF. The applicant estimates that up to 20.8 afy of groundwater will be pumped from the Lower Aquifer during operations and up to 144 afy of groundwater will be pumped from the Lower Aquifer during construction via an existing well located in the center of the proposed project site.

Near the CESF site, groundwater from the Lower Aquifer generally has lower quality than groundwater from the Upper Aquifer. Groundwater samples collected from a well that penetrates the Upper Aquifer had Total Dissolved Solids (TDS) readings between 564 and 847 mg/l, whereas samples collected from wells which penetrate the Lower Aquifer had TDS readings between 957 and 1140 mg/l (CESF, 2008k). State policy generally requires that power plants utilize the lowest quality water available for power plant cooling. While the CESF project is air cooled, targeting the lowest quality groundwater available at the project site adheres to the spirit of state water policy and preserves the higher quality groundwater in the Upper Aquifer for residential use.

In 1958, the DWR estimated annual pumping from the Carrizo Plain at 600 afy (DWR, 1958). Because no downward trends in groundwater elevations were observed during their investigation, the DWR assumed the average annual pumping was equal to average annual recharge. About 10 years later, Kemnitzer (1967) conducted a more comprehensive basin-wide study of Carrizo Plain groundwater and estimated a substantially larger average annual recharge value (approximately 59,000 afy). Kemnitzer (1967) estimated average annual pumping at 4,739 afy and therefore concluded about 55,000 afy of the recharge to the lower aquifer was lost to the north annually as underflow out of the basin. Kemnitzer's (1967) results suggest that the Carrizo Plain can supply more groundwater than was concluded by the DWR (1958) because the lost underflow could be captured by wells that pump from the Lower Aquifer. However, Kemnitzer (1967) did not provide observed Lower Aquifer groundwater level data to support the assumed northwestward flow, nor did his water budget calculations account for evaporation from the shallow water table (bare soil evaporation). Groundwater-flow modeling completed by the project applicant included bare soil evaporation and results indicated an average annual recharge rate of 14,324 afy, which is substantially lower than Kemnitzer's (1967) recharge estimate. Groundwater recharge estimated independently by Energy Commission staff using the Maxey-Eakin method indicated average annual recharge rates ranging from about 12,000 to 19,000 afy, which generally agrees with the groundwater-flow model results. These two independent analyses suggest that Kemnitzer (1967) overestimated recharge, and as a result overestimated flow out of the basin and the potential yield of the basin.

Groundwater Basin Modeling

CESF proposes to use about 254 acre feet of groundwater during the three year construction period including a maximum of about 144 afy during the first year of construction, followed by an annual use up to 20.8 afy for project operations. In the Carrizo Plain, significant increases in groundwater consumption may lower groundwater levels, reduce groundwater storage, and decrease discharge from the upper aquifer to springs, surface features (i.e., Soda Lake), and subsurface outflow (or "underflow", which in this case is Kemnitzer's assumed Lower Aquifer discharge).

URS developed a three-dimensional numerical groundwater-flow model of the Carizzo plain (herein referred to as the "Carrizo Plain model" or "the model") to assess impacts associated with the project's use of groundwater. The purpose of the model is to evaluate potential pumping effects on the underlying aquifers and wells located near the proposed project site. The model simulates groundwater level changes in response to extraction from pumping wells for construction, plant operation, and the potential combined impact from the proposed project and other planned groundwater uses. Additionally, sensitivity tests assessed uncertainty in aquifer parameters (vertical hydraulic conductivity between Upper and Lower aquifers), simulated pumpage, wellbore flow, and underflow out of the basin from the Lower Aquifer.

In applying models to real world groundwater-flow systems, errors can arise from conceptual deficiencies (i.e., erroneous basin geometry, incorrect boundary conditions, neglecting important processes, including inappropriate processes, and so forth), numerical deficiencies, inadequate specification of the aquifer's water transmitting and storage properties, and uncertainty in system stresses like recharge and pumping. It is therefore appropriate to assess the reliability of model results by considering the availability of data and uncertainty in the information utilized to develop the model.

The process of numerical groundwater-flow modeling involves first developing the conceptual model of the physical system and then applying mathematical equations to represent it quantitatively. A conceptual model is a clear, qualitative description of the natural system and its operation including water sources (recharge), flow directions, and sinks (discharge by pumping wells, evaporation from the shallow water table, and underflow). The numerical model utilizes mathematical equations to simulate the physical processes described by the conceptual model. The Carrizo plain model utilizes the numerical model MODFLOW, which is widely accepted and verified to produce numerically stable solutions (AW,1991).

Quantitative hydrogeologic and water use data for the Carrizo plain is sparse, and staff concurs with the applicant that URS' numerical model is a "scoping-level" or hypothesis-testing tool. The conceptual model is based largely on Kemnitzer (1967), supplemented by additional information where available. Key model components and their uncertainty are as follows.

Geologic Framework: The geologic framework describes the horizontal and vertical three-dimensional extent of the simulated water-bearing materials. The horizontal boundaries are assumed closed and coincide with watershed boundaries – except the northern boundary, which is open and allows underflow out of the basin from the Lower Aquifer. In the vertical dimension, the upper boundary is land surface and the lower boundary represents non-water bearing bedrock. The model utilizes six layers to represent variable water-bearing zones defined by the different stratigraphic units between land surface and bedrock.

Aquifer Parameters: Aquifer parameters include the water transmitting (transmissivity) and storage (specific yield and specific storage) properties of the stratigraphic units. The modeled hydraulic conductivity of the Upper and Lower aquifers was 1.0 and 2.5 feet per day, respectively (corresponding to a modeled transmissivity ranging from less than 300 to about 400 square feet per day). The modeled specific storage is 2.0E-05 per foot and specific yield ranges from 0.01 to 0.3.

Bechtel (1984) reported three test boreholes located within about 1.5 miles of the project's proposed pumping well. The borehole cuttings indicate significant spatial variability in subsurface aquifer conditions. Two of the three boreholes intersected primarily fine-grained sediments, while the third borehole intersected sufficient sand and gravel lenses to justify constructing a water supply well. Aquifer test results for a well constructed near the third test borehole determined the well had a long-term (20 year) expected yield of more than 115 gpm (185 acre-feet per year), and the estimated aquifer transmissivity ranged from 1,300 to 3,200 gallons per day per foot (170 to 430 square feet per day). These test results compare favorably with the modeled transmissivity, but no similar data is available to compare the modeled specific storage and specific yield.

In the Carrizo Plain model, transmissivity is modeled as uniform over most of the model area, which may over-simplify subsurface conditions based on the observed spatial variability reported by Bechtel (1984). The modeled contrast between Upper- and Lower Aquifer transmissivity values also seems inconsistent with the comparison between reported Upper and Lower Aquifer well yields. CESF (2009g) reported that Upper Aquifer well yields (a few gpm to 40 gpm) are approximately 10 to 100 times smaller than Lower Aquifer well yields (500 to 1,100 gpm), but modeled Upper Aquifer transmissivity is about the same as the modeled Lower Aquifer transmissivity (the two transmissivity values agree within about 25-percent). Controlled pumping tests are therefore needed to confirm modeled Lower Aquifer transmissivity values, develop transmissivity estimates for the Upper Aquifer, and assess the hydraulic connection, or lack thereof, between Upper and Lower Aquifers.

Recharge: The applicant's groundwater modeling simulated annual net recharge, which is the difference between simulated rainfall infiltration (60,641 afy) and simulated evaporation from the water table (46,317 afy). Net recharge simulated by the model is 14,324 afy, which is within the range of recharge values independently estimated by staff.

Staff employed the Maxey-Eakin method developed for desert water basins in Nevada, which have somewhat similar characteristics to the Carrizo Plain, to estimate recharge. The Maxey-Eakin method is an empirically derived relationship between precipitation and groundwater recharge within a basin. The method involves dividing the drainage basin into precipitation zones and scaling the mean annual volume of precipitation in each zone by a factor that accounts for losses by evapo-transpiration and surface water runoff; recharge is the volume of precipitation minus the evapotranspiration and surface runoff losses. The method was originally developed using discharge data and rainfall maps for 21 basins in Nevada. The Maxey-Eakin coefficient represents the percentage of the average annual precipitation volume that becomes groundwater recharge and ranges from 0% in areas with less than eight inches of average annual precipitation to 25% in areas with average annual precipitation greater than 25 inches.

In the Carrizo basin, average annual precipitation ranges from about eight inches in the valleys on the western side of the basin to greater than 13 inches in the coastal hills along the eastern boundary of the basin. The Maxey-Eakin coefficients for the Carrizo basin range from 3 % for areas with eight to 12 inches of average annual precipitation to 7% for areas with 12 to 15 inches of average annual precipitation. Staff utilized the USDA's PRISM geospatial dataset to estimate areas in various average annual precipitation zones to bracket the range of recharge for the basin. Recharge computations are presented below in **Soil and Water Resources Table 5**.

Soil & Water Table 5
Carrizo Basin – Maxey-Eakin Recharge Estimates

Area in Precipitation Zone[1] (acres)	Average Annual Precipitation (inches)	Maxey-Eakin Coefficient (lower bound)	Lower Bound Estimated Recharge (afy)	Maxey-Eakin Coefficient (upper bound)	Upper Bound Estimated Recharge (afy)
39,473	10.33	0.03	1,019	0.03	1,019
103,684	12.60	0.03	3,266	0.07	7,621
73,525	13.29	0.07	5,700	0.07	5,700
31,872	12.67	0.03	1,010	0.07	2,356
36,470	12.67	0.03	1,155	0.07	2,695
285,024			**12,150**		**19,391**

1) The Zones are based on the USGS delineation of average annual precipitation area.

Using the Maxey-Eakin method, staff estimates that groundwater recharge in the Carrizo basin ranges from 12,150 to 19,390 afy.

Water Budget: The water budget is a balance of water inflow and outflow. Uncertainty in the Carrizo Plain water budget primarily exists from uncertainty in pumpage and evapotranspiration estimates. Uncertainty in the water budget is a source for uncertainty in simulated water level changes and conclusions made in regards to basin yield.

In 1967, Kemnitzer (1967) identified 103 water supply wells in the Carrizo plain; however, in 2008 URS identified 86 wells within just three miles of the proposed site. The model simulates pumpage from active wells in approximately the northerly 25-percent of the Carrizo plain and within about five miles of the proposed project, but there is no simulated pumping in the remaining basin areas. The model may therefore under-represent the number and distribution of pumping wells, and as a result under-estimate the groundwater-pumping component of the water budget. Hence, more groundwater may be consumed by other existing users than is represented by the model.

The model indicates evaporation from the shallow water table removes more than 75-percent of annual rainfall infiltration, and evaporation is therefore the primary outflow in the water budget. In the Carrizo model, evaporation is simulated using MODFLOW's ET package, which represents evaporation as a function of water table depth and water transmitting characteristics of the soil. Simulated ET varies linearly with depth from a maximum rate of 5.5 feet per year at land surface to zero at a depth of 15 feet. The physical basis for the evaporation rate and extinction depth is not provided, nor was the sensitivity of model results to the specified evaporation function reported.

Belitz and others (1993) developed an evaporation function for the nearby western San Joaquin Valley using measured soil properties. Their function indicates a maximum evaporation rate of 32 feet per year when groundwater is at land surface, and that evaporation ceases at an extinction depth of seven feet below land surface. In the Carrizo plain model, a lower maximum evaporation rate (5.5 feet per year) may be reasonable in the Soda Lake bed area because of high groundwater salinity, which reduces vapor pressures and evaporation rates relative to the less-saline, “fresh” groundwater. However, the lower maximum evaporation rate may not apply to the remaining areas where groundwater salinity is much less. Similarly, the extinction depth (15 feet below land surface) is more than twice the depth estimated for the western San Joaquin Valley. Most of the Carrizo plain model cells have a simulated water table within 15 feet of land surface, indicating the evaporation function controls the simulated water table in the Upper Aquifer. The model is therefore presumably sensitive to the evaporation function, and without a physical basis to justify the specified evaporation rate and extinction depth there is uncertainty in simulated evaporation. This uncertainty in simulated evaporation is therefore a potential source for uncertainty in the simulated water budget, model derived estimates for basin yield, and simulated water level changes due to groundwater use in the basin.

Wellbore Flow: The existing on-site well was drilled to a depth of 630 feet below land surface. The casing is reportedly perforated from 75 to 630 feet, and the annulus outside the casing is packed with gravel from 630 feet to land surface. The lack of a sanitary seal is in violation of current county water well standards[1], and the combination of well screen depth interval and gravel pack provide a means of enhanced vertical groundwater movement between Upper and Lower aquifers. MODFLOW’s Multi-Node Well (MNW) Package was employed to simulate potential vertical groundwater flow in the casing and borehole between the Upper and Lower aquifers. Model results indicated that wellbore flow between the aquifers could be substantial. They also determined that if the well screen were sealed off from the Upper Aquifer, the proportional contribution of total well yield extracted from the Lower Aquifer would increase, thereby reducing pumping drawdown in the Upper Aquifer.

Model Calibration: The model was calibrated to match the general distribution of groundwater level elevations in the Upper Aquifer as reported by Kemnitzer (1967) and one groundwater elevation in the Lower Aquifer beneath the proposed project site. The lack of water level data limit the ability to confirm that the model accurately represents site specific groundwater-flow directions, vertical gradients between the Upper and Lower Aquifers, and trends in water level and groundwater storage changes (both seasonal and multi-year) at this time. The data available for model calibration and its limitations are summarized below.

- Water levels for three wells monitored by DWR indicate little change in water levels over the period 1963-1978 **(CESF2009g)**; however, no information is available on the depths of these wells.
- Depth to water measured in the proposed pumping well on February 14, 2008 (37.49 feet below land surface) and in 1965 when the well was constructed (about 30 feet

[1] Chapter 8.40.060 of the San Luis Obispo County Code states the depth of well seals (annular seals) shall be a minimum of 50 feet for community, domestic, industrial, and agricultural water wells. The Water Well Drillers Report provided in Appendix E for well 29S/18E-28 indicates the well is not sealed.

below land surface), are similar and are interpreted by CESF as indicating no substantial long-term decline in groundwater levels and storage.

- URS reported that Regional Water Quality Control Board data and other local well data indicate groundwater levels in the area have fluctuated over the years between a minimum of 14 feet to approximately 54 feet bgs.
- Bechtel's (1984) calculations to determine long-term yield from a nearby well assumed water levels in the Lower Aquifer decline byonefoot per year due to groundwater storage depletion. No information was provided to support the presumed regional water level and storage decline.

The lack of long-term water level data obfuscates groundwater storage conditions in the Carrizo Plain and creates a corresponding limitation on an assessment of model reliability. Groundwater levels and storage changes independent of project operations can occur (i.e., pumping increases from new wells installed by other users, intermittent drought conditions, and so forth). It is therefore prudent to track long-term groundwater conditions beneath and near the project site and attempt to isolate project-pumping impacts from changes in background conditions. This would require both on- and off-site water level monitoring.

In summary, staff recognizes that the model is a scoping level tool given the lack of data available to quantitatively characterize the groundwater basin and aquifer properties. Although staff has identified the key questions and uncertainties, staff concluded model results are likely sufficient to preliminarily estimate project pumping impacts during construction and operations. Because the lack of basin information precludes the reliable determination of the magnitude and extent of these impacts, staff developed conditions that limit groundwater use, minimize potential water level declines, confirm modeled aquifer parameters, and identify groundwater impacts in nearby wells, if any, so that they can be mitigated.

Groundwater – Potential for Construction Impacts

For the proposed project construction scenario, simulated pumping rates ranged from 144 afy (89 gpm) the first year of construction, followed by 73 afy and 39 afy in the second and third years of construction, respectively. Model results indicate that after the first year of pumping, Upper Aquifer water levels beneath the property boundary decrease 0.9 feet. Upper Aquifer water levels in wells located beyond the property boundary, and therefore further from the project pumping well, will have a simulated water level decline that is less than 0.9 feet. In the Lower Aquifer, where the well extracts most of the water, after the first year the simulated water level decline was 2.1 feet. Because the pumping rate decreases in years 2 and 3, the rate and magnitude of water level decline decreases.

The applicant's modeling assessment considered the sensitivity of the simulated water level drawdown to assumed vertical hydraulic conductivity. A larger vertical hydraulic conductivity results in greater leakage from the Upper to Lower Aquifer. For example, increasing the vertical conductivity between aquifers increased the simulated drawdown in the Upper Aquifer from 0.9 to 2.0 feet after the first year of construction (conversely, the drawdown in the Lower Aquifer decreased from 2.1 to about 0.9 feet). Alternatively, decreasing the vertical conductivity between Upper and Lower Aquifers has the opposite effect on water levels. After the first year of construction, the drawdown in the Upper Aquifer decreased from 2.1 feet to almost zero. Because the lower conductivity reduces leakage from the Upper Aquifer, most of the water extracted is derived from the Lower Aquifer which has the effect of increasing the drawdown from 2.1 to about seven feet.

Based on these modeling results, the applicant concluded the proposed construction pumping for the CESF project would not significantly affect groundwater levels or neighboring water supply wells which pump primarily from the Upper Aquifer. Staff agrees with the applicant's general assessment because the predicted Upper Aquifer drawdown in the vicinity of the project is less than one foot, and on average the water table is 35 feet above the top of existing well screens. The one foot of drawdown represents a one percent reduction in maximum theoretical well yield. Staff therefore does not expect significant impacts to groundwater users during project construction, but recognizes data is limited and there is uncertainty in quantitative estimates of the magnitude and extent of potential impacts. Staff therefore proposed conditions of certification intended to minimize impacts to the Upper Aquifer and to identify and mitigate impacts in future observed conditions should they occur. Specifically, these conditions limit project groundwater use, restrict groundwater pumping to only the Lower Aquifer, requires testing to confirm aquifer properties assumed in the modeling impact assessment, conduct monitoring to identify water level trends and changes owing to project groundwater use, and mitigation requirements should monitoring identify significant impacts have occurred. These conditions are described more completely below under the section "Groundwater Conditions of Certification", and the specific details of each condition provided in the section "Proposed Conditions of Certification".

Groundwater – Potential for Operations Impacts

For the proposed project scenario, simulated pumping in the model was increased by 20.8 afy to account for groundwater use by the project, and recharge was increased by 86 afy to account for increased stormwater infiltration in the project site's detention/ infiltration areas. Recharge was decreased by a similar amount down-gradient along Carriza Creek to account for reduced site runoff, the net effect being no change in recharge for the Carrizo Plain area represented by the model. As a result, the model indicates a water level rise in the Upper Aquifer beneath the site boundary by about 0.5 to 1.5 feet, and about 1 foot at a distance of 3,000 to 6,000 feet from the pumping well (CESF, 2009g). In the Lower Aquifer, the simulated extraction reduces water levels about 0.5 feet at a distance of 1,000 to 1,500 feet from the pumping well. Based on these results, the applicant concluded the proposed CESF project would not significantly affect groundwater levels or neighboring water supply wells which pump primarily from the Upper Aquifer. Staff agrees with the applicant's general assessment because the predicted drawdown is based on steady state operational conditions, residential wells in the vicinity of the project have on the average 35 feet of water above the top of their well screens, and 0.5 to 1.5 feet of drawdown results in less than a 7% reduction in maximum theoretical well yield.

Because data is limited and there is uncertainty in the model results, staff further examined assumed aquifer conditions and the recharge processes represented by the model. The purpose for this examination is to document the available data and information relied upon to prescribe conditions represented by the model and provide insight into the complex inter-relationships between physical processes that ultimately affect the groundwater resource. First, the Lower Aquifer is reportedly a confined to semi-confined aquifer with limited hydraulic connection to the Upper Aquifer. Second, the project's stormwater management plans are expected to increase stormwater infiltration resulting in greater Upper Aquifer recharge beneath the site. Finally, the project involves covering the majority of the site with mirrors and solar collectors to capture solar energy. The resulting shade will decrease vegetation growth and reduce evapo-transpiration losses, presumably increasing the accumulation of groundwater recharge to the Upper Aquifer. These three conditions and their potential influence on groundwater resources are discussed below

Upper and Lower Aquifer Connection

The hydraulic connection between Upper and Lower aquifers has not been quantified and is poorly understood. Significant fine-grained beds suggest the connection is limited, but the response of Upper Aquifer water levels to pumpage from the Lower Aquifer depends on the site specific water transmitting properties of the fine-grained beds. Based on previous studies and anecdotal evidence from local property owners, it seems the permeability of these fine-grained materials is low and the hydraulic connection between aquifers is limited.

Kemnitzer's review of well driller logs identified clay beds between the Upper and Lower Aquifers and concluded the low permeability clays act to confine groundwater in the Lower Aquifer (Kemnitzer, 1967). The Bechtel pump test report and drilling logs also noted the occurrence of sand and gravel water bearing layers within thick clay/silt layers, and a well water level above the upper boundary of the Lower Aquifer which they believed indicated semi-confined to confined groundwater conditions (Bechtel, 1984). The ARCO project was specified for a long-term withdrawal of 115 gpm from the Lower Aquifer (Bechtel, 1984). Staff has not been able to locate actual pumping or water use data from the ARCO project, however, communications with longtime resident, John Ruscovich, indicate that any pumping associated with the ARCO project did not result in noticeable impacts to groundwater levels or yields on the Carrizo Plain. In addition, communications with Sandra Rowlett, a longtime resident at the CESF site, indicates that the proposed CESF pumping well has been used to pump considerably more water on an annual basis to support irrigation over many years throughout the 1970s and 1980s without causing significant impacts to surrounding wells (Rowlett, 2009). The limited hydraulic connection between the Upper Aquifer, where most residential water supply wells extract their water, and the Lower Aquifer, from which the project shall obtain its water supply, reduces the expected impact of project pumping on existing residential wells.

Increased Infiltration

Staff also considered the potential that increased infiltration of stormwater was likely to increase groundwater recharge in the Upper Aquifer. The applicant has committed to installing BMPs such as infiltration trenches within the detention/ infiltration areas that will penetrate existing shallow clay layers to allow the areas to drain within 72 hours. These BMPs will allow a greater portion of rainfall at the site to percolate to the water table.

In the Hydrology and Hydrogeology Report the applicant applied a SCS Curve Number approach to 13 years of daily rainfall data to estimate average runoff depths for the project site (CESF, 2009b). The SCS Curve Number approach was developed by the Soil Conservation Service (now the National Resource Conservation Service) to estimate runoff volumes resulting from specific rainfall events taking into account soil types and land use practices. This analysis determined that on average 25% of the annual rainfall was lost to runoff under existing land use conditions. Therefore, 25% of the average annual rainfall at the 640-acre CESF site (about 106 acre-feet) would be expected to runoff the project site under pre-project conditions. Under project conditions, most of this runoff will be captured in the terraced infiltration areas or reside in perimeter swales designed to route upstream, off-site storm water around the site. Hence, almost 106 afy more rainfall will be available to infiltrate into the soil under project conditions than pre-project conditions. The project applicant determined that on average an additional 86 afy will actually infiltrate into the soil and recharge groundwater. This increase in infiltration is over four times greater than the project's anticipated groundwater pumping from the Lower Aquifer (20.8 afy). The additional recharge can offset a portion of the project's expected pumping impact on Upper Aquifer groundwater levels.

Evapo-transpiration Rate Changes

Staff considered changes in evapo-transpiration rates at the CESF site. The proposed project includes covering up to 90% of the CESF site with mirrors and collectors. These mirrors will track the sun, shading much of the ground below. This shading can be expected to significantly reduce plant growth, evapo-transpiration, and evaporation from the shallow water table. Potential changes in evapo-transpiration rates as a result of the proposed project were estimated using University of California Cooperative Extension (UCCE) and California Department of Water Resources guidelines to estimate evapo-transpiration rates (UCCE, 2000). The UCCE has published a Landscape Coefficient Method for estimating evapo-transpiration of landscape plants in California. The Landscape Coefficient Method utilizes a landscape coefficient that includes factors for plant species, density, and micro-climate to estimate evapo-transpiration for a given landscape plant from the standard ET_o published by the State Agencies (CIMIS). The species, density, and micro-climate factors are multiplicative:

$$ET_L = k_s * k_d * k_{mc} * ET_o$$

The density factor, k_d, ranges from 0.5-0.9 for low density plantings, 1.0 for average density, and 1.1-1.3 for high density plantings. Since the project site will be 90% covered with mirrors and no longer dry-farmed, it is reasonable to assume that plantings on the site will have a lower density than the existing pre-project conditions. The micro-climate factor, k_{mc}, ranges from 0.5 to 0.9 for low evapo-transpiration micro-climate, 1.0 for an average climate, and 1.1 to 1.4 for a high evapo-transpiration micro-climate. An average micro-climate is defined as an open field. A low evapo-transpiration micro-climate is defined as one that is shaded (such as from a building) or covered (such as from an overhang). Staff assumed a modest adjustment for a lower density with a k_d of 0.9 and a modest adjustment for a shaded micro-climate with a k_{mc} of 0.9. Thus, applying these factors, staff estimated the change in evapo-transpiration of 81% (i.e. a conservatively estimated decrease of 19%) for the project site following construction as compared to current conditions.

A simple water balance for the project site in the existing pre-construction and developed post construction conditions is presented below in **Soil and Water Resources Table 6**.

Soil & Water Table 6
CESF Site – Pre- and Post-Construction Water Balance

	Average Annual Rainfall (acre-feet)	**Average Annual Runoff (acre-feet)**	**Average Annual Evapo-transpiration (acre-feet)**	**Average Annual Recharge[1] (acre-feet)**
Pre-Construction Existing Conditions	427	106	289	32
Post-Construction Developed Conditions	427	0	311	116
Net Change	0	(106)	23	84

1. Average annual recharge is rainfall minus runoff minus evapo-transpiration.

The average annual rainfall on the 640-acre project site results in about 427 acre-feet of total rainfall volume. Under the existing conditions, about 25% or 106 acre-feet of the rainfall is lost from the site to runoff. Of the remaining rainfall, about 90% is lost to evapo-transpiration and about 33 acre-feet is left for recharge to the Upper Aquifer. This estimate of 32 afy recharge under existing conditions compares well to the Maxey-Eakin method, which indicated that groundwater recharge on the 640 acre project site would range from about 27.3 afy to 43.5 afy.

Following construction, all stormwater runoff will be captured onsite, so 100% of the average annual rainfall would either recharge the Upper Aquifer or be lost to evapo-transpiration. Staff estimates that evapo-transpiration rates will be reduced by at least 19% due to the land use changes, thus only about 73% (90% x 81%) of the average annual rainfall volume or about 311 acre-feet would be lost to evapo-transpiration and about 116 acre-feet would be left for recharge to the Upper Aquifer. Thus, staff estimates that average annual recharge to the Upper Aquifer could be expected to increase by about 84 acre-feet as a result of the proposed land use changes associated with the CESF project.

In addition, the septic system and leach field would also discharge up to 8.6 afy into the subsurface and a portion of this discharge would recharge the Upper Aquifer. Since it is not clear how much of the potable water supply would ultimately be discharged through the septic system, staff did not account for this additional source of recharge in their analysis. Obviously, additional recharge will offset a portion of the project's pumping and its effect on Upper Aquifer water levels. The septic tank and leach field will be designed to meet San Luis Obispo County standards and therefore septic system discharge is not expected to significantly impact Upper Aquifer water quality. For example, the potential nitrogen loading from a properly designed and constructed septic system is probably minor compared to the historical loads from fertilizer use at the site.

Operation Impact Assessment

Based on the model results and the conditions and processes discussed above, staff concurs with the applicant that groundwater pumping of 20.8 afy associated with the operations of the proposed CESF project will not result in significant adverse impacts to groundwater supplies or quality. Staff expects that the project's water use will be more than offset by increased groundwater recharge as a result of stormwater infiltration in the detention/infiltration areas and decreased evapo-transpiration. Increased Upper Aquifer recharge is expected to increase the elevation of the water table beneath the site, and therefore existing springs fed by the Upper Aquifer and located in the vicinity of the project, if any, are not expected to be significantly impacted by the project's operational water use.

Groundwater Conditions of Certification

Staff recognizes the limitations in available data and the ability to quantitatively characterize the groundwater basin and determine the magnitude and extent of impacts. Based on the information that is available, staff does not expect significant impacts to groundwater to occur during either construction or operation. However, staff has proposed conditions of certification that will permit the identification and minimization of impacts, should they occur.

Staff proposes Condition of Certification **SOIL&WATER-6** which limits total groundwater use during the three-year construction period to a maximum of 150 afy and no more than 275 acre-feet total. Staff believes by using chemical dust controls (approved by the CPM), that construction water use can be significantly reduced after grading is completed. During operations, the Carrizo Energy Solar Farm shall not use more than 25 acre-feet of groundwater during any one-year period and no more than 65 acre-feet of groundwater during any consecutive three-year period. These limitations ensure actual construction and operational groundwater use is reasonably similar to levels considered by CESF's impact assessment.

Staff proposes Condition of Certification **SOIL&WATER-7**, requiring the project owner to verify that the proposed pumping well (DWR Well I.D. T29S/R18E-L03) is constructed according to San Luis Obispo County standards, has sufficient capacity to provide the project's water supply, and the screen and annulus outside the casing is sealed to effectively isolate the Upper Aquifer and ensure groundwater is intentionally extracted only from the Lower Aquifer. If the existing pumping well needs to be replaced, Condition of Certification **SOIL&WATER-7** requires the project owner to abandon the existing pumping well and construct a new pumping well (screened exclusively within the Lower Aquifer) in accordance with San Luis Obispo County and State requirements.

Staff proposes Condition of Certification **SOIL&WATER-8** which requires an aquifer test on the completed water supply well (either the existing well after sealing or new well screened exclusively within the Lower Aquifer). The test objectives are: (1) determine site-specific aquifer parameter values (transmissivity and specific storage); (2) quantify potential water level drawdown within the Lower Aquifer; and, (3) quantify potential water level changes in the Upper Aquifer due to pumping from the underlying Lower Aquifer. Test measurements and monitoring would be conducted using the monitoring wells recommended in **SOIL&WATER-9**.

Staff proposes Condition of Certification **SOIL&WATER-9** which requires background and site groundwater level monitoring in the Upper and Lower aquifers. The primary objective for the monitoring is to establish background trends in off-site wells which can be compared against site trends both near the pumping well and at the property boundaries. Monitoring shall commence prior to project construction to maximize the pre-project data set.

Staff proposes Condition of Certification **SOIL&WATER-10** and **SOIL&WATER-11** which require mitigation for significant drawdown impacts should they be identified as part of the background and site groundwater level monitoring.

Details on these Conditions of Certification are provided below in the section "Proposed Conditions of Certification".

CUMULATIVE IMPACTS AND MITIGATION

Project Water Supply

Staff evaluated the potential cumulative impacts that could be caused by the proposed CESF project's use of groundwater in combination with the proposed water use at the FirstSolar's Topaz Solar Farm (TSF) project. FirstSolar's proposed TSF project includes placement of photo-voltaic cells on 4,100 acres of land north and east of the CESF site. FirstSolar's TSF project estimates that it will require about 26.7 afy during a three-year construction period, and about 3.5 afy during operation.

In addition, staff considered whether the proposed SunPower California Valley Solar Ranch (CVSR) which proposes to utilize about 36.4 afy of groundwater during construction and 11.7 afy of groundwater during operations could contribute to cumulative impacts. The SunPower project is located more than six miles east of the CESF site. Given the relatively low groundwater withdrawal rates proposed for SunPower as compared to the CESF pumping rates and the distance from the CESF site, staff determined that any cumulative impacts created by the two projects would not be significant.

Groundwater

Staff requested the CESF applicant to also provide groundwater modeling that reflects a combined projects scenario including anticipated groundwater pumping for both the CESF project and FirstSolar's TSF project. The applicant added a second hypothetical pumping well that penetrated the Lower Aquifer on Section 21 just north of the CESF project site for FirstSolar's TSF. There is an existing residential well that is directly between the proposed CESF pumping well and the location of the hypothetical FirstSolar's TSF well, so the analysis provides the most conservative modeling results (i.e. models the greatest potential impact at the residential well). While the materials submitted to date by FirstSolar do not identify a specific well or pumping depth, it is reasonable to assume that FirstSolar will be required to pump from the Lower Aquifer to target the lowest quality groundwater for construction and operations at the TSF.

For the combined CESF and FirstSolar's TSF scenario, pumping was increased for both the transient CESF construction model and the steady state CESF operations model to account for the two proposed projects. Recharge was adjusted at the CESF site and along the Carriza Creek to account for increased infiltration of stormwater in the detention/infiltration areas.

During construction of the CESF project and construction of the Topaz Solar Farm project, modeling results indicate that groundwater levels in the Upper Aquifer decreased by about 0.8 feet at the residential well between the CESF site and Topaz Solar Farm site. In the Lower Aquifer, the groundwater model indicates that about two feet of drawdown is expected at the CESF site boundary in the vicinity of the residential well between the two sites. These impacts are expected to be short term, worst case scenarios reflecting maximum pumping rates at both project sites during construction. The potential impact is considered less than significant because the predicted drawdown at the residential well is temporary, residential wells have on the average 35 feet of water above the top of their well screens, and a drawdown of two feet results in less than a 10% reduction in maximum theoretical well yield.

During operation of the CESF project and construction of the TSF project, evaporation from the water table decreased by about 43.6 afy as compared to the no-project existing conditions scenario. Groundwater elevations in the Upper Aquifer increased by about 1.0 to 1.5 feet at the CESF project site boundary and about one foot 1500 to 4000 feet from the CESF pumping well (CESF, 2008k). At the residential well between the proposed CESF pumping well and the hypothetical TSF well, groundwater levels in the Upper Aquifer increase by about 1.4 feet, indicating that the existing well would not be significantly impacted. In the Lower Aquifer, groundwater elevations decreased by about 0.5 feet within 1000 to 2000 feet of the CESF pumping well and decreased by about 0.5 feet approximately 3000 feet from the hypothetical TSF well. Based on these results, the applicant concludes that there will be no significant impact to groundwater resources as a result of the combined pumping associated with the proposed CESF and FirstSolar's TSF projects.

FirstSolar's Topaz Solar Farm project includes installation of photovoltaic cells over 4,100 acres of land on the Carrizo Plain. Similar to the CESF project, staff believes that these photovoltaic cells will cause significant shading of the ground surface decreasing vegetation growth and evapo-transpiration. As described above for the CESF site, this shade could result in a decrease of at least 19% in evapo-transpiration rates. Staff believes that the TSF project will result in a similar if not greater decrease in evapo-transpiration, and that recharge to the Upper Aquifer may also likely increase. Therefore, staff does not believe the two proposed projects will result in significant impacts to groundwater resources of the Carrizo Plain.

PUBLIC AND AGENCY COMMENTS

CDFG

CDFG-1 In a March 26, 2008 letter to the Energy Commission, the California Department of Fish and Game provided comments on the applicant's AFC. Related to Soil and Water Resources, the CDFG requested that the applicant reconsider placement of fill in Carriza Creek by eliminating the two proposed crossings of the creek channel. Alternatively, if the crossings cannot be eliminated, CDFG requested that the proposed culverts be replaced by temporary spans.

Response to CDFG-1
Staff concurs with CDFG's request and has recommended in Condition of Certification **SOIL&WATER-2** that the applicant develop and implement a design to span Carriza Creek at both crossings. The applicant will also need to demonstrate that the crossings provide sufficient capacity to pass a 100-year flow rate without increasing flood depths upstream. The applicant had determined that the two permanent creek crossings are a necessary component of the project description for the project to be successfully completed and operated. The applicant indicates the two permanent crossings are required to facilitate access by providing a turn around for large trucks during construction.

CDFG-2 In a December 31, 2008 letter to the Energy Commission, the CDFG Game requested that the fueling station be relocated away from Carriza Creek to limit the potential for spills to impact the creek and to eliminate the need for the Carriza Creek crossings.

Response to CDFG-2
In response to staff's request, the applicant has moved the fueling station to the northeast corner of the laydown area, away from Carriza Creek.

CENTRAL COAST RWQCB

RWQCB-1 In a December 13, 2007 letter to the Energy Commission, the Central Coast RWQCB provided comments on the applicant's AFC. Related to soil and water resources, the RWQCB requested that Low Impact Design (LID) approaches be included in the project to limit potential impacts from stormwater discharge.

Response to RWQCB-1
Staff reviewed the applicant's proposed stormwater management plans and determined that the proposed plans utilize LID approaches to limit runoff volumes and flow rates discharged from the project site to below pre-project levels.

RWQCB-2 In a March 13, 2009 e-mail to the Energy Commission, the Central Coast RWQCB provided comments and questions regarding the Preliminary Staff Assessment. Related to Soil and Water Resources, the RWQCB offered the following questions/comments:

1. The RWQCB would like to see the cumulative impact on groundwater supplies and recharge addressed for all three solar projects (CESF, TSF, and CVSR) collectively

as part of a cumulative impacts analysis. Reduced evapo-transpiration could be a major factor to result in increase in groundwater recharge to the Upper Aquifer. Could this be interpreted as an aquifer banking approach?

2. How will the high TDS water from the lower aquifer be treated before washing the mirrors and collectors? If untreated, this wash water could create salt problems in the Upper Aquifer.

3. Is the estimated drawdown in the Lower Aquifer of 0.5 feet on an annual basis? Are there estimates of recharge available?

4. We need to look carefully at the stormwater drainage routes proposed to go around the site to make sure that the channels can handle large rain events.

5. Condition of Certification **Soil and Water-5** may not apply in this area of San Luis Obispo County. Since there is not sanitary sewer to accept discharge on the Carrizo Plain, a Permit for Industrial Wastewater Discharge may not be applicable.

<u>Response to RWQCB-2</u>
On PSA Comment 1, staff required the applicant to examine cumulative impacts associated with groundwater pumping at the FirstSolar's TSF project proposed for the area adjacent and north of the CESF Site. Cumulative impacts related to the proposed pumping at both sites were examined by the applicant, and this analysis was reviewed and confirmed by staff as described in detail in the Cumulative Impacts Section above. The applicant modeled a combined projects scenario including pumping from CESF and TSF and determined that the two projects would not result in significant cumulative impacts to groundwater levels at the CESF property boundary. Information on the SunPower California Valley Solar Ranch came in late in the CESF process. Since the SunPower site is located six miles east of the CESF site and the pumping proposed for the SunPower site is within the range already assumed for the area's agricultural pumping, staff and the applicant agreed that cumulative impacts between the SunPower project and CESF were not likely to be significant.

Staff does agree with the RWQCB that these solar projects are likely to significantly reduce evapo-transpiration and increase groundwater recharge to the Upper Aquifer. Since the level of increased recharge is difficult to quantify at this stage, we have not adopted an approach to provide any kind of formal water banking credit to the proposed solar projects like CESF. However, staff has considered reduced evapo-transpiration when analyzing potential groundwater supply drawdown impacts.

On PSA Comment 2, the applicant plans to use treated groundwater with a low concentration of a bio-degradable detergent to clean the mirrors and collectors. The water would be softened to remove calcium carbonate and sodium carbonate prior to use in the solar field. Therefore, use of this water will not cause salt problems in the Upper Aquifer.

On PSA Comment 3, the reductions in water levels in the Lower Aquifer discussed in the PSA were based on "steady state" conditions with continuous pumping to support operations. The simulated steady-state drawdown represents the drawdown required to support a long period of continuous pumping at a constant rate. The steady-state drawdown results therefore represent maximum drawdown for the specified pumping. For construction water use, the applicant utilized a transient groundwater model to assess impacts after 1, 2, and three years of pumping at progressively lower rates.

Staff has included recharge estimates in the FSA. Using the Maxey-Eakin method staff estimated that recharge for the Carrizo basin ranged from 12,150 to 19,400 afy or about 29 to 47 afy per square mile. The applicant's groundwater modeling indicated that recharge for the basin was about 14,325 afy.

On PSA Comment 4, staff reviewed the conceptual plans for the proposed perimeter swales and confirmed that the swales can convey the 5-year design flow. Events greater than the 5-year event would flow across the solar field terraces and either be captured in the terraces or routed across SR-58 as in the current conditions. In the final DRESCP, the applicant will have to present detailed design information on the perimeter swales including stabilization at the swale bends and the method to route runoff across SR-58.

On PSA Comment 5, staff has removed the Condition of Certification requiring a Permit for Wastewater Discharge. Staff had included this permit to provide the RWQCB with the opportunity to examine wastewater treatment during construction and operations including plans to handle hydrostatic test water, ZLD system design, and collector wash water. As we understand that the RWQCB does not plan to review and comment on these plans, this Condition is not required.

SLO COUNTY – DEPARTMENT OF AGRICULTURE

<u>SLO–DOA-1</u> In a December 30, 2008 letter to the Energy Commission, the San Luis Obispo County Department of Agriculture provided comments on staff's PSA. Related to soil and water resources, the SLO Department of Agriculture offered comments on:

1. County Agriculture Policy 11 stating that groundwater supplies are to be protected for productive agriculture in both quantity and quality. Relying on DWR's 1958 estimate of safe yield for the Carrizo basin of 600 afy, the proposed water use at CESF represents 3.5% of total safe yield. The site's soils can hold up to 9.2 inches of moisture and a site-specific study of the soils at the site would be needed to assess any increases in infiltration. Finally, mitigation could include requiring the applicant to capture, retain, and utilize onsite precipitation for the project's water supply.

2. The temporary laydown area including several suggested practices to protect and restore the agricultural productivity of the laydown area during and following construction.

<u>Response to SLO-DOA-1</u>
On Comment 1, staff determined that the proposed project would protect groundwater supplies in both quantity and quality through several measures. First the project utilizes dry cooling to significantly reduce water requirements. Secondly, staff required the applicant to include infiltration BMPs to penetrate existing clay layers in the site soils to increase stormwater infiltration and percolation to the water table. Finally, based on the

changes in land use, evapo-transpiration, which accounts for the vast majority rainfall losses at the site, is expected to significantly decrease. Staff considered retaining precipitation onsite for use as a water supply throughout the year; however, this would result in an unreliable water supply and would greatly increase losses due to evaporation. Therefore, staff does not believe that capture and retention above-ground of onsite precipitation would offer an appropriate water supply for the project.

On Comment 2, staff included all of the Agriculture Departments suggested practices to protect and restore the agricultural productivity of the laydown area following construction as part of the BMPs in the DRSECP as required under Condition of Certification **Soil & Water-2**.

CURE

CURE-1 California Unions for Reliable Energy provided comments on the PSA in a January 15, 2009 letter to the Energy Commission. Related to Soil and Water Resources, CURE offered the following comments (in summary):

1. CURE states that the PSA must clarify whether the project will result in significant impacts to groundwater supply. CURE asserts that staff's analysis is conflicting regarding that "the project could result in significant impacts to water supply if the construction water supply is significantly underestimated" and "the use of groundwater for process and potable needs will not result in significant impacts to existing or future users of groundwater."

2. The PSA must analyze significant impacts to Soda Lake. Specifically, if Soda Lake would be impacted by the discharge of toxic chemicals released during construction or by migration of existing toxic materials through migration of soils in surface water flows.

3. CURE agrees with staff, that the applicant should reconsider placing fill in Carriza Creek for the proposed access road and turnaround.

4. The DRSECP and SWPPPs should be available for public review and comment during the CEQA process.

Response to CURE-1
On Comment 1, staff determined that the proposed use of 20.8 afy of groundwater during operations would not result in a significant impact to existing groundwater supplies. However, staff could not verify the proposed water supply quantity during construction, so staff could not determine if construction water use could result in a significant impact at the time of the PSA. Since the PSA, the applicant has revised their estimates of construction water use, and while staff believes that the available information about proposed construction water use supports a conclusion that it will not result in a significant impact to groundwater supplies, there is limited information related to the hydrogeology at the project site. Therefore, staff is requiring the applicant to conduct a pump test to verify assumptions in the groundwater modeling, perform monitoring to determine if pumping is causing a significant impact, and to compensate neighboring well users if a significant impact occurs during the pumping period.

Although staff believes any such impacts are unlikely, the Conditions of Certification ensure that unexpected impacts will be detected and mitigated.

On Comments two and 4, staff examined potential impacts to Soda Lake through both altering the delivery of runoff to the lake or through the discharge of toxic materials during construction from erosion of existing soils from the site. Regarding runoff delivery, staff determined that the potential change in total runoff delivered to Soda Lake would not be significant. Regarding the discharge of toxic materials during construction or through erosion, staff reviewed the applicant's draft DESCP and determined that the measures contained in the applicant's plans are sufficient to prevent the potential for toxic materials to be released from the site during construction or through erosion. The draft DRSECP is available for public review and comment. A final DRSECP is required prior to construction. The DRSECP will be reviewed by both SLO County and the Energy Commission, and implementation of the BMPs identified in the plan is required.

PUBLIC

Robin Bell – Carrisa Alliance for Responsible Energy

Bell-1 Robin Bell provided numerous questions and comments throughout the project workshop process. In a March 27, 2009 letter, Ms. Bell offered a number of comments on the Applicant's Hydrology and Hydrogeology report and by extension staff's PSA (comments summarized):

1. What is the source of backup water supplied via water truck? If the source is from an aquifer in the Carriza Plain please revise the Hydrology Report to include this impact.

2. The laydown area can be redesigned to avoid the Carriza Creek crossings. The real need for the creek crossings is to facilitate US Army Corps of Engineers review of the project. These crossings have the potential to impact Vernal Pool Fairy Shrimp and Longhorn Fairy Shrimp. Please include avoidance of the creek crossings as a condition of certification.

3. The Hydrology and Hydrogeology Report relies on information from Kemnitzer that is 40 years old and Bechtel that is 25 years old. Land uses on the Carriza Plain have changed since those early studies and previous reports of large volumes pumped from the Lower Aquifer without significant impacts may not be valid today. The Energy Commission should require the Applicant to perform a ten-day pump test at full pumping volume while monitoring the effect on the Upper Aquifer. Please include a monitoring plan for water levels in the Upper Aquifer through the life of the project to ensure that local residential wells are not impacted by the project's pumping. Please include a pre-determined mitigation plan should CESF affect local wells.

Response to Bell-1
Staff considered Ms. Bell's comments while formulating analysis and Conditions of Certification in the FSA.

On Comment 1, staff limited total use of groundwater and total volumes of backup water that may be trucked into the CESF site to support construction and operations in

Condition of Certification **SOIL&WATER-6**. The applicant's proposed backup water supply is to truck water from San Luis Obispo, Paso Robles or other regionally-available water supplies.

On Comment 2, staff concurs with Ms. Bell and CDFG, that the Carriza Creek crossings should be reconsidered or redesigned. Staff has required the applicant to utilize temporary spans to cross the Carriza Creek. The applicant is required to procure permits from the US Army Corps of Engineers, Central Coast RWQCB, and CDFG for the proposed creek crossings. Staff has required the applicant to demonstrate that the proposed creek crossings have been designed to limit the potential for flooding impacts to upstream properties due to back water affects and erosion impacts at the downstream outfall of each crossing.

On Comment 3, staff recognizes that there is limited information available on the hydrogeologic conditions on the Carriza Plain. The applicant and staff have relied on available information to develop the modeling and analysis in the Hydrology and Hydrogeology Report and FSA, respectively. Staff also recognizes that there is considerable uncertainty in the results of groundwater modeling with the limited information available. When the applicant determined that construction water use would increase to a maximum of 144 afy, staff added additional Conditions of Certification to address these uncertainties, monitor for potential impacts and provide a framework for mitigation of potential impacts should they arise.

Staff concurs with the applicant regarding the potential for impacts to neighboring residential wells, i.e. staff does not believe that the proposed pumping during construction or operation will result in significant impacts to neighboring wells. However, given the limited hydrogeologic information available, staff could not conclude with absolute certainty the neighboring wells would not be impacted, particularly as a result of construction period pumping. As a result, staff included Conditions of Certification **SOIL&WATER-7, -8, -9, -10,** and **-11** requiring the applicant to: retrofit or replace the pumping well to ensure that the pumping well pumps from the Lower Aquifer, perform a pump test, implement a groundwater monitoring program, assess potential impacts to neighboring residential wells, and reimburse neighboring well users for potential impacts.

John Ruscovich

John Ruscovich provided numerous comments to the PSA and to the applicant's Hydrology Report in a December 30, 2008 e-mail to the Energy Commission, in a January 6, 2009 letter to the Energy Commission, and in March 15, 2009 Data Requests to the applicant.

Ruscovich-1 In a December 30, 2008 e-mail to the Energy Commission, Mr. Ruscovich offered the following comments (in summary):

1. The Bechtel well report from 1984 indicates that four test holes were drilled on the adjacent ARCO Site, two came up dry and two hit water. The well that was completed was pumped for the 72-hour pump test and was not utilized again based on information from a former ARCO employee. Hence the entire Hydrology and Hydrogeology Report is "null and void".

2. The two largest agricultural wells on Sections two and three have collapsed. The large agricultural well on Section 29 has not been run in many years. The water data in the Hydrology and Hydrogeology Report is from over 25 years ago and is no longer valid.

3. The applicant used rainfall statistics from 1982 and 1983, which both had over 12-inches of rainfall, but the past two years have had less than average rainfall. The applicant should base their studies only on the past two years of below average rainfall.

Response to Ruscovich-1
Staff and the applicant made efforts to discuss Mr. Ruscovich's concerns and learn from his extensive local knowledge of the area throughout the Public Workshops.

On Comment 1, the applicant and staff reviewed information provided in the 1984 Bechtel boring logs and pump test to develop knowledge about the sub-surface conditions in the vicinity of the site. The boring logs and pump test data were utilized by the applicant to determine aquifer properties in a manner customary to the standards of hydrogeologic practice. Specific information related to the pumping history of this well was not available to either the applicant or staff.

On Comment 2, well collapse is often related to the buildup of Calcium Carbonate and/or Iron Hydroxides on the well screen. In addition waters with high saline concentrations can lead to chemical corrosion of well casings leading to collapse. Given the high iron content and high TDS and electrical conductivity levels of groundwater in the Lower Aquifer, older agricultural wells would be susceptible to clogging and corrosion of the well screen and eventual collapse. Thus, staff does not believe that the collapse of older agricultural wells has any specific bearing on the groundwater analysis provided in the PSA, FSA, or the applicant's Hydrology and Hydrogeology Report.

On Comment 3, the applicant utilized customary practices to develop estimates of average annual rainfall, which include developing a long-term average that reflects both dry years and wet years.

Ruscovich-2 In a January 6, 2009 letter to the Energy Commission, Mr. Ruscovich offered the following comments (in summary):

4. We have proof that the test performed (2/15/08) on the proposed pumping well at the CESF site was inaccurate, as the sample was not pulled from the proposed pumping well.

5. Please re-review the applicant's Hydrology and Hydrogeology Report and look into the many problems and inaccuracies in the report, the first being that it is a 40 year old report done in 1967.

6. The California Lodge and Springs Report (7/2/02) included as an appendix in the applicant's Hydrology and Hydrogeology Report states that there was a well drilled

on my land, which never happened. Just more proof of a poor or false Well Report, again submitted by Asura/URS.

7. You keep referencing the two big Ag Wells: the 1100 gpm well on Section 3 collapsed in the early 1990’s, the 600 gpm well on Section two collapsed in the late 80’s, and the well listed on Section 27 (ARCO site) does not exist.

8. Where is the 14-inch cast, 620 feet deep well on Section 27? It is not anywhere on the old ARCO section of land. “Prove to us there is water there, you can’t unless you drill a well”.

<u>Response to Ruscovich-2</u>
On Comment 4, the applicant addressed the sampling of the pumping well at the CESF site in the revised Hydrology and Hydrogeology Report. The applicant indicates that this well was sampled for water quality including purging of four casing volumes prior to extraction groundwater samples based on standard industry practices.

On Comment 5, the applicant utilized a study by Kemnitzer from 1967 as a starting point in their hydrogeologic analysis. This is a standard scientific practice. The applicant’s study ultimately concluded that evapo-transpiration was considerably higher and groundwater recharge was much lower than predicted by Kemnitzer in 1967.

On Comment 6, the applicant requested all information available on groundwater wells. The California Lodge and Springs Report was submitted in response and included as an appendix to the Hydrology and Hydrogeology Report. Mr. Ruscovich fails to provide any specific details on how the inclusion of this information impacts the analysis presented in the PSA, FSA, or the Hydrology and Hydrogeology Report.

On Comment 7, similar to Comment 2, staff would expect that older agricultural wells on the Carrisa Plain would be subject to collapse due to the high iron content and high TDS and electrical conductivity levels of groundwater in the Lower Aquifer.

On Comment 8, this comment seems to contradict Mr. Ruscovich’s earlier comment about the well on the ARCO site. In Comment 1, Mr. Ruscovich states that the ARCO well was drilled but not actively utilized and in Comment 8, Mr. Ruscovich states that the well does not exist and therefore there is no proof that water is actually there. Staff believes that the ARCO well was likely abandoned when ARCO dismantled the previous solar plant. Also, information from Sandra Rowlett, long time owner of the CESF site, indicates that the CESF pumping well has an extensive history of agricultural pumping to irrigate 80-100 acres of alfalfa and carrots.

<u>Ruscovich-3</u> In a set of March 13, 2009 letter data requests to the Applicant, Mr. Ruscovich asked for several sets of specific data related to water use at sites on the Carriza Plain and offered the following comments related to soil and water resources (in summary):

9. Please complete a water report with actual water use from 2008/09. Mr. Ruscovich's water use at his ranch was 5.35 afy on 3.75 sections of land including household water use, landscaping, and 6000 sq. feet of lawn.

10. Justify the estimated construction water use of up to 144 afy. Please include monitoring depths of water at local wells to safeguard other water users. If for any reason, local water users experience an impact procedures should be in place to rectify the issue. Wells to be monitored should include John Ruscovich, Gordon Hay, Carrisa Plains Elementary School, California Valley Community Service District, and Mike Strobridge.

11. The applicant stated that average rainfall in the vicinity of the project site was 8-10 inches per year. However, in only two of the past nine years was rainfall greater than that average (records attached).

12. Provide data on the 11 big Ag Wells referenced in the Hydrology and Hydrogeology Report on the Carrisa Plain. Provide the current land owners, section numbers, gpm capacity and pump down, date the wells were last used and how many months the wells have run.

13. For the ARCO site, the 1984 Bechtel report indicates that two dry wells were drilled and one well was completed to 620 feet deep with a 12-inch casing. The estimated capacity was 115 gpm. Please provide the years the well was pumped, any long term pumping problems, water quality data, were there any problems with neighboring wells due to that pumping, provide the actual location of the well.

14. The Hydrology Report states that the applicant is planning on buying water and trucking it to the site. Please state who the water will be purchased from and where the wells providing the water are located,

15. The Hydrology Report states that the California Valley Restaurant and Hotel uses 14 afy. Please provide information on how many days the restaurant is open, how many rooms does the hotel have and what is the average nightly occupancy, how many square feet of lawn is irrigated, where the three acres of trees are planted.

<u>Response to Ruscovich-3</u>
On Comment 9, staff appreciates Mr. Ruscovich's detailed information on water use on his ranch. It is not clear if Mr. Ruscovich provided this information to the applicant for inclusion in the groundwater modeling performed by the applicant. However, most groundwater users on the Carrisa Plain do not meter their pumping and do not maintain data on drawdown, so Mr. Ruscovich's request that the Hydrogeologic study be performed based on actual water use data from 2008/09 is not realistic.

On Comment 10, staff shares Mr. Ruscovich's concern regarding the proposed pumping during construction. When the applicant determined that construction water use would increase to a maximum of 144 afy, staff added additional Conditions of Certification to address these uncertainties, monitor for potential impacts and provide a framework for mitigation of potential impacts should they arise.

Staff concurs with the applicant regarding the potential for impacts to neighboring residential wells, i.e. staff does not believe that the proposed pumping during construction or operation will result in significant impacts to neighboring wells. However, given the limited hydrogeologic information available, staff could not conclude with absolute certainty the neighboring wells would not be impacted, particularly as a result of construction period pumping. As a result staff included Conditions of Certification **SOIL&WATER-7, -8, -9, -10,** and **-11** requiring the applicant to: retrofit or replace the pumping well to ensure that the pumping well pumps from the Lower Aquifer, perform a pump test, implement a groundwater monitoring program, assess potential impacts to neighboring residential wells, and reimburse neighboring well users for potential impacts.

On Comment 11, staff reviewed the rainfall data submitted by Mr. Ruscovich. The data indicate that rainfall averaged 9.2 inches per year from 1997 through 2008, and 10.2 inches per year from 1965 through 2008. Thus, the data provided by Mr. Ruscovich confirms the estimated average rainfall of eight to 10 inches in the vicinity of the CESF Site provided by the applicant.

On Comments 12 and 13, Mr. Ruscovich requests detailed data on well ownership, capacity, and use for 11 agricultural wells on the Carrisa Plain as well as the ARCO well. The applicant requested this information at Data Request workshops. This specific well information is private and not publicly available. Therefore, it is not reasonable to request the applicant to provide information that is not available.

On Comment 14, staff limited total use of groundwater and total volumes of back up water that may be trucked into the CESF site to support construction and operations in Condition of Certification **SOIL&WATER-6**. This will address any potential impacts related to trucked water.

On Comment 15, The California Valley Restaurant and Hotel are about four miles from the CESF site. Staff does not believe that the details related to the water use at the California Valley Restaurant and Hotel have any significant bearing on the analysis presented in PSA, FSA, or the Hydrology and Hydrogeology Report. In addition, Mr. Ruscovich fails to provide any specific details on how the inclusion of this information impacts the analysis presented in the PSA, FSA, or the Hydrology and Hydrogeology Report.

Michael Strobridge

Michael Strobridge provided numerous comments to the PSA in a December 9, 2008 letter to the Energy Commission. In addition Mr. Strobridge provided several comments and questions in March 8, 2009 Data Requests to the applicant.

Strobridge-1 In the December 9, 2008 letter to the Energy Commission, Mr. Strobridge offered the following comments (in summary):

1. 4.9-5 Regional Water Resources, Energy Commission states that the natural water resources of the Carrizo Plain are extremely limited and that ground water serves as

the primary water supply for the region. The SLO County Master Water Plan Update states that the Carrizo Plains is in an overdraft. (SLO County 2001) This document is the most recent information on the Carrizo water basin. It concerns me that CEC has dismissed this document. It also concerns me that over half of the reference material in this water report was supplied by URS. The Carrizo Plains does not have the water resources to support the CESF and local residents. I have supplied the WPA8 update proving this fact only to be dismissed. As a home owner 2800ft from the proposed CESF site I will continue to persist on seeing the CEC's documentation proving otherwise. I firmly believe that Ausra should be required to perform a ground water basin and aquifer study of the Carrizo Plains since there is no accurate information to back CEC's or URS's theories. The WPA8 states some data is as old as 40 years, example the only reference is to a study done in 1967 by Kemnitzer. It is also important to note that most of the basins have not been studied in detail, and true perennial yield values are not known. Thus, much of the information does not reflect current conditions, population, water usage, and agricultural trends. It also tends to point out the necessity of developing new data to more accurately describe the hydrologic conditions of the water basins. (SLO COUNTY 2001 WPA8)

2. 4.9-14 Method and Threshold for Determining Significance- "Impacts associated with the proposed project, including depletion of local/regional water supplies ,… are among those staff believes can be potentially significant" "Both the applicant and staff examined this issue in detail, and determined that groundwater levels in the Upper Aquifer that local domestic users utilize for water supplies are expected to increase…"(PSA Page 4.9-33) Both of these statements are made and I am uncertain on two aspects. Number 1, how can the CEC determine that the depletion of ground water to be significant and then turn around and say residential water supplies are going to increase? Number 2, if the project is going to increase the upper aquifer, where is the water coming from and what data does the CEC have to support this statement? When water is consumed, the only result is a decrease; this is a simple math equation. If the so called Detention/infiltration areas are the only reason for these conclusions they are extremely inaccurate. SLO County Ag Department has stated that the Carissa Plains is one of the most excellent areas in the county for dryland farming because of our soils exceptional moisture retention. The soil retains moisture because of a clay layer that traps the water and keeps it close to the surface. For this plain fact these detention/infiltration areas will not work like URS states they will. I insist the CEC rethink these infiltration areas and take into consideration the fact that they will not work in the plains.

3. 4.9-7 Groundwater, Wells within the Lower Aquifer can yield as much as 500 to 1100 gpm(Kemnitzer, 1967). CEC states that Ausra's onsite well is 591 feet bgs with 14-inch diameter steel casing and screen and that this well will be fitted with a 75 hp, (500 gpm) submersible pump to extract water from the lower aquifer. URS stated in the August 5th workshop that their onsite well only produced 50 gpm (URS 6/5/08 page 125 line 8). If Ausra pumps with a 75 hp, (500gpm) submersible pump they will grossly over pump this well. This would drastically drop the lower aquifer at the property line and beyond. Is a 50 gpm well sufficient to support the CESF? Does Ausra plan on punching more wells ever? CEC states wells that penetrate the Lower Aquifer provide irrigation water supply and community water supply (Bechtel, 1984). The CEC has provided this information proving that community water is supplied by

the Lower Aquifer and that the CESF would have an enormous impact on local water supplies. I strongly believe that CEC should take into consideration that some community water supplies come from the lower aquifer. The onsite well planned to be used by the CESF has almost collapsed in the past from previous large scale use(Rowlett 2008). This onsite well cannot support the CESF. This onsite well has a turbine installed on it. This turbine is old and rusted. How did URS remove this turbine to install a submersible pump? If URS actually did test this well what size submersible did they use? I am concerned that URS did not even test this well as I saw no significant amounts of water on ground. I would have to insist that Ausra perform a pump test on this onsite well using the 75 horsepower submersible pump they plan on using. A 72hr test would be sufficient while monitoring the upper aquifer from a test hole. I would like to see a local well driller on site or a CEC representative to make sure all tests are done properly and honestly.

4. 4.9-28 Groundwater, CEC states that Ausra used a groundwater model to update Kemnitzers 1967 estimates. The applicant identified 86 wells on the Carrizo Plain and assigned pumping rates of one afy to domestic wells and a 35% duty cycle to irrigation wells. This groundwater model is inaccurate. The SLO County Master Water Plan ranchettes of 2.5 acres to 20 acres and more use more water than a conventional home. The average water usage for a ranchette according to SLO County is 1.8 afy for inland areas (SLO County Master Water Plan 2001). The pumping rates for the CESF ground water modeling are incorrect. According to BLM maps, the entire Carrizo Plain extends down to Soda Lake (BLM Monument map 2007). There are more than 86 homes in the entire Carrizo Plain. According to the SLO County Master Water Plan there were 432 homes just in California Valley in 1995 at a water demand of 730 afy. This same document shows a projected demand in 2020 of 1090 afy with 642 homes (SLO County Master water Plan 2001). This does not include homes in the northern Carrizo Plain. Each home has a minimum of one well and this does not include irrigation wells. The safe yearly yield for the Carrizo Plains is only 600afy (SLO County WPA8 2001). I insist that CEC count individual homes in the Carrizo Plain to get a better estimate of the number of wells. The CEC cannot ignore these extra wells. They utilize the same water basin as the Northern Carrizo Plain and will be equally affected. I insist CEC rerun water modeling including these extra wells with the proper pumping rates. URS's well information is pathetic to say the least. URS has not made any effort to contact myself or my neighbor Santos Reyes about our wells. We are less than one mile from the CESF site.

5. 4.9-32 Cumulative Impacts and Mitigation, staff requested the CESF applicant to also provide groundwater modeling that reflects a combined projects scenario including anticipated groundwater pumping for both the CESF project and Optisolar's Topaz Solar Farm project. The applicant added a second hypothetical pumping well that penetrated the Lower aquifer on Section 21 just north of the CESF project site for Optisolar's Topaz Solar Farm. There is an existing residential well (Strobridge) that is directly between the proposed CESF pumping well and the location of the hypothetical Optisolar Topaz solar Farm well, so this hypothetical location results (i.e. models the greatest potential impact at the residential well). While the materials submitted to date by Optisolar do not identify a specific pumping well or the depth of the planned groundwater withdrawal, it is reasonable to assume

that Optisolar will be required to pump from the Lower Aquifer to target the lowest quality groundwater for construction and operations at the Topaz Solar Farm. My home is in section 21. My well only produces 13 gpm and will stop running after four hrs of continuous running. My submersible pump sits at 140 ft. This hypothetical well is absurd. I drilled a 450ft well on the North West side of my property in section 21 and never hit a drop of water. The only water available is in the south east corner of my land. What pumping rates and depths was this hypothetical set at? According to Optsolar there are several wells on the TSF site producing 40-60 gpm and there are five old agricultural wells producing 10 gpm (SLO COUNTY Optisolar application 2008). I know for a fact that at least one of these wells is in the upper aquifer located in section 29 adjacent to the CESF. CEC states that they assume Optisolar will be pumping from the lower aquifer. This is unacceptable. I do not appreciate any assumptions that affect the welfare of my family. I demand to see fact with documentation not assumptions. Assumptions that the upper aquifer will increase by 1.4 ft is ridiculous. Storm water detention/infiltration areas will not collect enough water to affect the upper aquifer. CEC is assuming that there will be rain. What happens if there is minimal rain? I insist the CEC show data showing the affects of the CESF on the water supply in minimal precipitation conditions. According to the SLO County Public Works Department the Carrizo Plains received a total of 6.16 inches of rain in 2007-2008 in two months of the year. The same document shows the Carrizo Plains receiving 2.32 inches of rain in 2006-2007(Slo County Public Works CDF#175). I firmly believe cumulative impacts need to be revaluated with realistic rain data.

6. 9-42 References, Per meeting on December 15 Mark Lindley of the CEC water staff stated that his conclusion after Bechtel 1984 was one of his deciding factors of adequate water supply because of the studies done on the Arco Industrial Site. I have searched for this document and it is not available to the public. If this is the most recent information; dated 25yrs ago that CEC is basing its findings of adequate water supply I insist on researching this document since a reference must have adequate access if it is cited as a documented reliable resource.

<u>Response to Strobridge-1</u>
On Comment 1, staff reviewed the information submitted by Mr. Strobridge including the analysis in the San Luis County Master Plan. The San Luis County Master plan based estimates for safe seasonal yield on the 1958 CDWR Bulletin 118. This bulletin estimated total use in the basin in 1958 and assumed that the total use was equal to the safe seasonal yield. There was no significant analysis of the basin in the earlier DWR study.

The applicant has developed the most detailed hydrogeologic study of the basin to date. The applicant requested well information, pumping records, and developed a detailed groundwater model of the basin. The applicant’s estimates of annual recharge are within the range estimated by staff utilizing the Maxey-Eakin method developed for desert areas in Nevada. Staff recognizes there is limited hydrogeologic information available. As a result, staff included Conditions of Certification **SOIL&WATER-7, -8, -9, -10,** and **-11** requiring the applicant to: retrofit or replace the pumping well to ensure that the pumping well pumps from the Lower Aquifer, perform a pump test, implement a groundwater monitoring program, assess potential impacts to neighboring residential wells, and reimburse neighboring well users for potential impacts.

On Comment 2, in discussing the thresholds for significance, staff indicated that impacts related to depletion of local groundwater supplies were among those that staff believed could be **potentially** significant, i.e. staff analyzed whether this **potentially** significant impact was likely and if adequate mitigation was in place to mitigate the impact to a less than significant level. By laying out thresholds staff was not indicating that there was an actual impact expected only that there could be and staff would analyze whether there would be any impacts. Based on staff's analysis, we determined that the land use changes at the site were likely to balance water use at the site and result in increased groundwater recharge. The water balance for the Carrisa Plain indicates that the vast majority of all rainfall, about 90%, is lost to evapo-transpiration. By changing the land use at the site, including covering the site with mirrors and solar collectors, the project is expected to alter the water balance at the site, decreasing evaporation and increasing recharge. This is backed up by common sense, does it feel hotter in the shade or in direct sunlight? In addition, the detention/infiltration areas will include infiltration BMPs that penetrate the clay layers near the ground surface to allow rainfall runoff to better percolate into the subsurface. On average, the project site receives 426 afy of rainfall, the project's operational water use of 20.8 afy is less than 5% of average annual rainfall. By decreasing runoff and evapo-transpiration, staff believes that the proposed project will have a positive effect on groundwater recharge at the site that more than offsets operational water use.

On Comment 3, staff has included limits on total groundwater pumping during construction and operation in Condition of Certification **SOIL&WATER-6**, which limits that applicant from pumping significantly more groundwater than was analyzed in the Hydrology and Hydrogeology Report and this FSA. The applicant's engineers will determine the size of pump and motor to be installed on the project's pumping well given project's needs, the limits identified in the Conditions of Certification, and engineering judgment. Often engineers will oversize a pump and motor, to allow a given pump and motor to run at a lower rpm to decrease wear and lower long term maintenance costs. Condition of Certification **SOIL&WATER-7** requires the applicant to retrofit the proposed pumping well or replace it with a well that would be screened and sealed to pump exclusively from the Lower Aquifer. Conditions of Certification **SOIL&WATER-8, -9, -10**, and **-11** require the applicant to perform a pump test, implement a groundwater monitoring program, monitor for potential impacts, and reimburse neighboring groundwater users if impacts are detected.

On Comment 4, the applicant provided an opportunity at several public workshops for concerned neighbors, to provide input on groundwater wells and pumping on their property. Mr. Strobridge had ample opportunity to provide details to the applicant for inclusion in the groundwater modeling. Mr. Strobridge's well is included in the Applicant's groundwater modeling and was examined specifically when looking at the potential for cumulative impacts for the combined CESF and Topaz Optisolar projects. The Applicant's groundwater model reflected total pumping of 2,626 afy in their groundwater modeling. The one afy estimate for existing residential wells was based on observations of limited agricultural activities and household gardening on the Carrizo Plain. As discussed above in response to Comment 1, the safe yield estimate provided by the CDWR in 1958 was based on very limited data with very limited scientific investigation. Staff believes that the Applicant performed a detailed and diligent study of water use on the Carrizo Plain given the data available. This was further verified by staff estimates of basin recharge and water use on the Carriza Plain.

On Comment 5, the applicant included a hypothetical well because the Topaz OptiSolar project had not provided detailed information identifying one or more proposed pumping wells at the time of their study. The Topaz OptiSolar project is under review with San Luis Obispo County, and the ultimate decisions related to approval and conditions for that project will be determined by the County. Staff assumes that San Luis Obispo County will require the Topaz OptiSolar project to pump from the Lower Aquifer to limit the potential to impact neighboring groundwater users. As described above in response to Comment 2, the determination that groundwater levels are expected to increase as a result of the proposed project is primarily related to decreased evapo-transpiration at the project site as a result of changes in land use. As discussed above in response to a Comment 11 from Mr. Ruscovich, rainfall data provided by Mr. Ruscovich for the area confirm the Applicant's estimates for average annual rainfall.

On Comment 6, the Bechtel 1984 study provided the only true pump test based on current engineering practice for the area on a section of land adjacent to the project site. Based on this pump test Bechtel concluded that the well on the ARCO site could yield 112 gpm continuously. The Bechtel study was provided in the Applicant's Hydrology and Hydrogeology Report available for download from the Energy Commission's website. By comparison, CESF proposes to pump a maximum of 89 gpm during the first year of construction and 12.9 gpm during operation.

COMPLIANCE WITH LORS

WATER SUPPLY

The Carrizo Plain is not subject to adjudication, and the use of groundwater for construction, process water and potable uses is permitted on the Carrizo Plain.

The project would comply with:

- The Clean Water Act and the authority granted to the State to enforce coverage under the NPDES by the Central Coast Regional Water Quality Control Board and the San Luis Obispo County – Developmental Services and Flood Control Department to administer the requirements and preparation of the SWPPPs and Drainage Report and Sedimentation and Erosion Control Plan;
- The Resource Conservation Recovery Act of 1976 by the proper handling and discharge of wastewater;
- The California Constitution, Article X, Section two and SWRCB Resolution 75-58 by using the lowest quality groundwater reasonably available to CESF for all plant construction and operation uses;

- The Porter-Cologne Water Quality Control Act by the implementation of the DRSECP and SWPPP;
- The California Safe Drinking Water and Toxic Enforcement Act by establishing secondary containment in chemical storage areas;
- Title 23 of the California Code of Regulations requiring the Regional Board to specify conditions for protection of water quality as applicable: In the case of CESF, the project would be permitted under the General NPDES Permits for Discharge of Stormwater associated with both construction and industrial activity.
- The Energy Commission's 2003 Integrated Energy Policy Report, promoting water conservation, for which the project would comply by use of air cooled condensers instead of wet cooling processes and by using ZLD for treatment and reuse of process wastewater.

CONCLUSIONS

Staff has not identified any immitigable potentially significant impacts to Soil and Water Resources for the Carrizo Energy Solar Farm (CESF) and believes the project will comply with all applicable Laws, Ordinances, Regulations and Standards (LORS) provided the proposed conditions of certification are implemented.

Staff concludes the following:

- Implementation of Best Management Practices during CESF construction and operation in accordance with effective Storm Water Pollution Prevention Plans and a Drainage Report and Sedimentation and Erosion Control Plan would avoid significant adverse effects that could otherwise result in significant transport of sediments or contaminants from the site by wind or water erosion.
- Hydrogeologic information is insufficient to determine the extent of potential impacts from CESF construction groundwater use on the local groundwater supply and neighboring groundwater users. Therefore, staff has included Conditions of Certification requiring well construction specifications, aquifer tests using the proposed pumping well and groundwater monitoring wells, monitoring of on- and off-site groundwater levels, and, if necessary, compensation of neighboring groundwater users in the event the groundwater supply is determined to be significantly impacted by construction water use. These conditions are sufficient to ensure that any significant impacts that do occur can be mitigated to a level such that they are not significant.
- Historical land and water use practices suggest the proposed operational groundwater use for the project's process and potable water needs during operation should not cause a significant adverse environmental impact or affect current or future groundwater users.
- Groundwater from the Lower Aquifer is the most degraded quality water supply reasonably available to the project, and staff considers its use by the project consistent with state water use and conservation policies.

- The proposed use of air-cooled condensers for cooling and recovery of process wastewater using Zero-Liquid-Discharge technology is consistent with state water use and conservation policies.
- The project would not be located within the 100-year flood plain, and would not exacerbate flood conditions downstream of the project.
- The proposed sanitary waste water system includes a 2,500-gallon septic tank and leach field. However, the septic tank appears to be undersized given the applicant's estimate of potable water use. Staff's proposed conditions of certification require the applicant to reconcile the difference between the estimates of potable water use in the septic tank design vs. the water supply estimates and to use a septic tank that is adequately sized.

Where the potential for impacts has been identified, staff is proposing mitigation measures to reduce the impact to less than significant. The mitigation measures, as well as specifications for LORS conformance, are included as conditions of certification.

PROPOSED CONDITIONS OF CERTIFICATION

SOIL&WATER-1: The project owner shall comply with the requirements of the general National Pollutant Discharge Elimination System (NPDES) permit for discharge of stormwater associated with construction activity. The project owner shall develop and implement a construction stormwater pollution prevention plan (construction SWPPP) for the construction of the Carrizo Energy Solar Farm site, laydown area, and all linear facilities.

Verification: The project owner shall submit to the compliance project manager (CPM) a copy of the construction SWPPP prior to site mobilization and retain a copy on site. The project owner shall submit copies to the CPM of all correspondence between the project owner and the Central Coast Regional Water Quality Control Board regarding the NPDES permit for the discharge of stormwater associated with construction activity within 10 days of its receipt or submittal. Copies of correspondence shall include the notice of intent sent to the State Water Resources Control Board, and the board's confirmation letter indicating receipt and acceptance of the notice of intent.

SOIL&WATER-2: Prior to site mobilization, the project owner shall obtain CPM approval for a Drainage Report and Sedimentation and Erosion Control Plan (DRSECP) for managing stormwater and protecting soil resources during project construction and operations as normally administered by the San Luis Obispo County – Developmental Services and Flood Control Department. The DRSECP must address the following:

1. ensure proper protection of water quality and soil resources;
2. demonstrate no increase in off-site flooding potential;
3. include provisions for sediment and stormwater retention from both the Power Block and Solar Field terraces to meet San Luis Obispo County requirements;

4. address exposed soil treatments in the Solar Field terraces for both road and non-road surfaces including specifically identifying all chemical based dust palliatives, soil bonding, and weighting agents appropriate for use on the Carrizo Plain;

5. maintain and restore agricultural productivity in the laydown area;

6. design and demonstrate that the two crossings of Carrizo Creek using bridge spans will not cause flooding upstream; and

7. identify all monitoring and maintenance activities.

The DRSECP shall contain elements one through 10 below outlining site management activities and erosion- and sediment-control BMPs to be implemented during site mobilization, excavation, construction, and post construction (operating) activities.

1. **Vicinity Map** – A map(s) at a minimum scale 1”=100’ shall be provided indicating the location of all project elements (construction site, laydown area, pipelines) with depictions of all significant geographic features including swales, storm drains, and sensitive areas.

2. **Site Delineation** – All areas subject to soil disturbance for the Carrizo Energy Solar Farm (project site, laydown area, all linear facilities, landscaping areas, and any other project elements) shall be delineated showing boundary lines of all construction areas and the location of all existing and proposed structures, pipelines, roads, and drainage facilities.

3. **Watercourses and Critical Areas** – The DRSECP shall show the location of all nearby watercourses including swales, storm drains, and drainage ditches. It shall indicate the proximity of those features to the Carrizo Energy Solar Farm construction, laydown, and landscape areas and all transmission and pipeline construction corridors.

4. **Drainage Map** – The DRSECP shall provide a topographic site map(s) at a minimum scale of 1”=100’ showing existing, interim, and proposed drainage swales and drainage systems and drainage-area boundaries. On the map, spot elevations are required where relatively flat conditions exist. The spot elevations and contours shall be extended off site for a minimum distance of 100 feet.

5. **Drainage of Project Site Narrative** – The DRSECP shall include a narrative of the drainage measures necessary to protect the site and potentially affected soil and water resources within the drainage downstream of the site. The narrative shall include the summary pages from the hydraulic analysis prepared by a professional engineer and erosion control specialist. The narrative shall state the watershed size(s) in acres that was used in the calculation of drainage features. The hydraulic analysis shall be used to support the selection of BMPs and

structural controls to divert off-site and on-site drainage around or through the Carrizo Energy Solar Farm site and laydown and linear areas.

6. **Clearing and Grading Plans** – The DRSECP shall provide a delineation of all areas to be cleared of vegetation and areas to be preserved. The plan shall provide elevations, slopes, locations, and extent of all proposed grading as shown by contours, cross sections, or other means. The locations of any disposal areas, fills, or other special features shall also be shown. Existing and proposed topography shall be illustrated by tying in proposed contours with existing topography.

7. **Clearing and Grading Narrative** – The DRSECP shall include a table with the quantities of material excavated or filled for the site and all project elements (project site, laydown area, transmission and pipeline corridors, roadways, and bridges) whether such excavation or fill is temporary or permanent, and the amount of such material to be imported or exported.

8. **Best Management Practices Plan** – The DRSECP shall identify on the topographic site map(s) the location of the site specific BMPs to be employed during each phase of construction (initial grading, project element excavation and construction, and final grading/stabilization). BMPs shall include measures designed to prevent wind and water erosion including application of chemical dust palliatives after rough grading to limit water use, and measures to protect the agricultural productivity of existing topsoil. All dust palliatives, soil binders and weighting agents shall be approved by the CPM for environmental compatibility with the Carrizo Plain.

9. **Best Management Practices Narrative** – The DRSECP shall show the location (as identified in 8 above), timing, and maintenance schedule of all erosion- and sediment-control BMPs to be used prior to initial grading, during all project element (site, pipelines) excavations and construction, final grading/stabilization, and operation. Separate BMP implementation schedules shall be provided for each project element for each phase of construction. The maintenance schedule shall include post-construction maintenance of structural-control BMPs, or a statement provided about when such information will be available.

10. **Agricultural Productivity Narrative** – The DRSECP shall include plans to protect existing topsoil in the project laydown area during construction and detailed plans to restore the agricultural productivity of the laydown area following construction. The plans should include the location of soil protection BMPs (as identified in 8 above), timing, and maintenance schedule of all soil protection BMPs to be used at the site laydown area prior to initial grading, during construction of the temporary storage and manufacturing buildings, during collector assembly, and following construction.

Verification: No later than 90 days prior to start of site mobilization, the project owner shall submit a copy of the DRSECP for construction activity and operations to

San Luis Obispo County – Developmental Services and Flood Control Department and the Central Coast Regional Water Quality Control Board (Central Coast RWQCB) for review and comment. No later than 60 days prior to start of site mobilization, the project owner shall submit the DRSECP with the county's and Central Coast RWQCB's comments to the CPM for review and approval. The CPM shall consider comments by the county and Central Coast RWQCB before approval of the DRSECP. The DRSECP shall be consistent with the grading and drainage plan as required by condition of certification **CIVIL 1**, and relevant portions of the DRSECP shall clearly show approval by the chief building official. The DRSECP shall be a separate plan from the SWPPP developed in conjunction with any NPDES permit for Construction Activity. The project owner shall provide in the monthly compliance report a narrative on the effectiveness of the drainage, erosion, and sediment-control measures including application of dust palliatives, and the results of monitoring and maintenance activities. Once operational, the project owner shall update and maintain the DRSECP for the life of the project and shall provide in the annual compliance report information on the results of monitoring and maintenance activities.

SOIL&WATER-3: The project owner shall comply with the requirements of the general NPDES permit for discharges of stormwater associated with industrial activity. The project owner shall develop and implement an industrial stormwater pollution prevention plan for the operation of CESF.

Verification: The project owner shall submit to the CPM a copy of the industrial SWPPP for operation of the CESF prior to commercial operation, and shall retain a copy on site. The project owner shall submit copies to the CPM of all correspondence between the project owner and the Central Coast RWQCB regarding the general NPDES permit for discharge of stormwater associated with industrial activity within 10 days of its receipt or submittal. Copies of correspondence shall include the Notice of Intent sent by the project owner to the State Water Resources Control Board.

SOIL&WATER-4: The project owner shall treat all process wastewater streams with a zero liquid discharge (ZLD) system that results in a residual solid waste stored in resin cartridges. The resin cartridges shall be recycled and the solid waste shall be disposed of in the appropriate class of landfill suitable for the constituent concentrations in the waste. Surface or subsurface disposal of process wastewater from the Carrizo Energy Solar Farm (CESF) is prohibited. The project owner shall operate the ZLD system in accordance with a ZLD management plan approved by the CPM. The ZLD management plan shall include the following elements:

A. A flow diagram showing all water sources and wastewater disposal methods at the power plant;

B. A narrative of expected operation and maintenance of the ZLD system;

C. A narrative of the redundant or back-up wastewater disposal method to be implemented during periods of ZLD system shutdown or maintenance;

D. A maintenance schedule;

E. A description of on-site storage facilities and containment measures;

F. A table identifying influent water quality; and

G. A table characterizing the constituent concentrations of the solid waste or brine and specifying the permit limits of the selected landfill.

The CESF operation and process wastewater production shall not exceed the treatment capacity of the ZLD system or result in an industrial wastewater discharge.

Verification: At least 60 days prior to the start of commercial operation, the project owner shall submit to the CPM evidence that the final design of the ZLD system has the approval of the CBO. At least 60 days prior to the start of commercial operation, the project owner shall prepare a ZLD management plan for review and approval by the CPM. The ZLD management plan shall be updated by the project owner and submitted to the CPM for review and approval if a change in water source or infrastructure is needed.

In the annual compliance report, the project owner shall submit a status report on operation of the ZLD system. The status report shall include: dates and length of disruptions, maintenance activities performed, volumes of interim wastewater streams stored on site, monthly volumes of residual salt cake or brine generated, and results of at least one annual sampling of the waste solids or brine comparing the constituent concentrations to the permit limits of the landfill. The annual compliance report shall contain an evaluation of whether the ZLD is being operated within the parameters described in the ZLD management plan. The ZLD management plan shall be updated by the project owner if the CPM has determined it is necessary based on the project owner's annual compliance report(s).

SOIL&WATER-5: The project owner will comply with the requirements of the San Luis Obispo County Code, Title 19, Building and Construction Ordinance Section 19.20.220 Sewage Disposal Systems regarding a Septic Facility Permit for sanitary waste disposal facilities including the Carrizo Energy Solar Farm's proposed septic system and leach field.

Verification: The project owner will submit all necessary information and the appropriate fee to the San Luis Obispo County – Building and Planning Department to ensure that the project has complied with the county's sanitary waste disposal facilities requirements. At least 60 days prior to the start of operation, the project owner shall provide a written assessment prepared by San Luis Obispo County demonstrating the project's compliance with these requirements to the CPM for review and approval.

SOIL&WATER-6: During construction, the Carrizo Solar Energy Farm shall not use more than 150 acre-feet of groundwater during any one year period or more than 275 acre-feet of groundwater during the three year construction period. During operations, the Carrizo Energy Solar Farm shall not use more than 25 acre-feet of groundwater during any one-year period and no more than 65 acre-feet of groundwater during any consecutive three-year period. Back up water trucked into the project site shall be limited to two acre-feet per year.

Prior to the use of groundwater during construction and commercial operation by the CESF, the project owner shall install and maintain metering devices as part of the water supply and distribution system to monitor and record in gallons per day the total volumes of water supplied to the CESF from each water source. Those metering devices shall be operational for the life of the project.

The project owner shall prepare an annual Water Use Summary, which will include the daily usage, monthly range and monthly average of daily non-potable water usage in gallons per day, and total groundwater used by the project on a monthly and annual basis in acre-feet. Potable water use on-site shall be recorded on a monthly basis. For subsequent years, the annual Water Use Summary shall also include the yearly range and yearly average water use by the project. The project owner shall include the groundwater monitoring data required under **SOIL&WATER-9** annually to the CPM as part of the Water Use Summary. The annual summary of water use and groundwater monitoring data shall be submitted to the CPM as part of the annual compliance report.

Verification: At least 60 days prior to commercial operation of the CESF, the project owner shall submit to the CPM conclusive proof that metering devices have been installed and are operational on the groundwater supply and distribution system. The project owner will document total groundwater usage and report groundwater usage to the CPM. The project owner will report all disruptions to the groundwater supply, the water treatment process, the volume of backup water used, and the total annual groundwater use for the year, and the two years prior, in the annual compliance report. The project owner shall also provide a report on the servicing, testing and calibration of the metering devices in the annual compliance report.

SOIL&WATER-7: The project owner shall verify that the project pumping well on the Carrizo Solar Energy Farm site (DWR Well I.D. T29S/R18E-L03) is constructed in accordance with county well standards, has sufficient capacity to provide project water supply, is screened exclusively within the Lower Aquifer, and is sealed between the Upper and Lower Aquifers. If the project pumping well (DWR Well I.D. T29S/R18E-L03) needs to be replaced during the life of the project, the project owner shall follow San Luis Obispo County requirements for abandonment of the existing well and drilling of a new pumping well screened within the Lower Aquifer. The project owner shall ensure that any new wells are completed in accordance with all applicable state and local water well construction permits and requirements. Prior to initiation of well construction activities, the project owner shall submit a well construction application to the San Luis Obispo County – Department of Environmental Health, containing all documentation, plans, and fees normally required for the county’s well permit, with copies to the CPM. The project shall not construct a supply well or extract and use any groundwater therefrom until the San Luis Obispo County issues its written evaluation as to whether the proposed well construction and operation activities comply with all applicable county well requirements, and the CPM provides approval to construct the well. The project owner shall provide documentation to the CPM that the well has been properly completed. In accordance with California's Water Code section 13754, the driller of the well shall submit to the Department of Water Resources (DWR) a Well Completion Report for each well installed. The project owner shall ensure the Well Completion reports are submitted. The project owner shall ensure compliance with all county water well standards and requirements for the life of the existing pumping well and any new pumping wells and shall provide the CPM with two (2) copies of all monitoring or other reports required for compliance with the San Luis Obispo County water well standards and operation requirements, as well as any changes made to the operation of the well.

Verification: The project owner shall do all of the following:

1. No later than thirty (30) days prior to the construction of an onsite replacement water supply well, the project owner shall submit two (2) copies to the CPM of the water well construction packet submitted to the San Luis Obispo County – Department of Environmental Health.

2. No later than fifteen (15) days prior to the construction of an onsite replacement water supply well, the project owner shall submit two (2) copies of the written concurrence document from the San Luis Obispo County – Department of Environmental Health indicating that the proposed well construction activities comply with all county well requirements and meet the requirements established by the county's water well permit program .

3. No later than 60 days after installation of any replacement water supply well at the project site, the project owner shall ensure that the well driller submits a Well Completion Report to the DWR with a copy provided to the CPM. The project owner shall submit to the CPM together with the Well Completion Report a copy of well drilling logs, water quality analyses, and any inspection reports that may be completed.

During well construction and for the operational life of the well, the project owner shall:

1. Submit copies to the CPM any proposed well construction or operation changes for the existing pumping well or newly constructed wells.

2. Submit copies of any water well monitoring reports required by the San Luis Obispo County – Department of Environmental Health to the CPM in the annual compliance report.

3. No later than fifteen (15) days after completion of onsite replacement water supply wells, the project owner shall submit documentation to the CPM and the RWQCB that well drilling activities were conducted in compliance with Title 23, California Code of Regulations, Chapter 15, Discharges of Hazardous Wastes to Land, (23 CCR, sections 2510 et seq.) requirements and that any onsite drilling sumps used for project drilling activities were removed in compliance with 23 CCR section 2511(c).

SOIL&WATER-8: Before the start of plant construction, the project owner shall plan and complete an aquifer testing program to verify parameter values utilized in the groundwater-flow model. Specifically, the aquifer testing program shall (1) determine site-specific aquifer parameter values (transmissivity and specific storage); (2) quantify potential water level changes within the Lower Aquifer; and, (3) quantify potential water level changes in the Upper Aquifer due to pumping from the underlying Lower Aquifer. The test shall be conducted using a pumping rate similar to the planned construction pumping rate for a minimum duration of 72 hours. Water levels shall be monitored and measured at appropriate intervals using data recorders to record drawdown during pumping and water level rise during recovery. Water levels shall be monitored in the Upper Aquifer monitoring well located near the pumping well (required by **SOIL&WATER-9)**; the project pumping well (after completing pumping well modifications or replacement of the pumping well, as required by **SOIL&WATER-7)**; and, the on- and off-site Upper and Lower aquifer monitoring wells required by **SOIL&WATER-9**. Additionally, as separate subsequent tests the three sets of site monitoring wells required by **SOIL&WATER-9** shall also be independently pumped using temporary submersible pumps, and the water level drawdown and recovery within the well shall be used to estimate the water transmitting properties of the aquifer sediments in which they are constructed.

Verification: The project owner shall do the following:

1. At least 180-days prior to construction, an Aquifer Testing Work Plan shall be submitted to the CPM for approval. The work plan shall include, but is not limited to, a description of the following:

- Description of site conceptual model based on new geologic and lithologic data from monitoring well construction, the existing site production well log, and other well logs obtained as part of **SOIL&WATER-9**.
- Baseline water level trends represented by pre-construction water level monitoring as required by **SOIL&WATER-9**.
- Planned test pumping rates and test duration.
- The location, method, and recording frequency employed to monitor pumping rates and water level changes.
- Anticipated pumping test drawdown in the pumped well and monitoring wells.
- Planned data analysis methods.

The aquifer test shall be conducted after work plan approval by the CPM and test procedures are modified to reflect any changes requested by the CPM.

2. After approval of the Aquifer Testing Work Plan and at least 30-days prior to construction, an Aquifer Test Report shall be prepared and submitted to the CPM. The purposes of the report are to document the aquifer test data, summarize the estimated aquifer parameters, compare aquifer test results to assumed aquifer parameters for the site, and if necessary update the groundwater-flow model and subsequent impact assessment. The report shall include the following components:

- The aquifer test data, data analysis, and analysis results shall be included in both narrative and tabulated formats. The report shall include a narrative description of the test, plots of the time-series data before, during, and after the test (pumping rate, pumping water level change, and water level recovery), and curve-matching results for the empirical test data and appropriate analytical model.

- The test-derived and modeled horizontal hydraulic conductivity and specific storage values shall be quantitatively compared. If the differences are greater than 10% , the model shall be updated to better represent measured hydraulic conductivity beneath the site.
- The vertical hydraulic communication between Upper and Lower Aquifers shall be assessed by a comparison between measured and simulated water level changes during the pumping test. If a measurable change is confirmed, the groundwater-flow model shall be employed to analyze the aquifer test data. For example, if a change in Upper Aquifer water levels is measured as a result of Lower Aquifer pumping, the groundwater-flow model shall be employed to simulate the aquifer test and if necessary re-calibrate modeled conductivity and/or storage properties to match observed water level transients under test conditions. Similarly, if Lower Aquifer water levels change as a result of Upper Aquifer pumping, the model shall be employed to simulate the test and if necessary re-calibrate modeled conductivity and/or storage properties.
- If horizontal conductivity or specific storage are increased by 10% or more, or the re-calibrated vertical hydraulic conductivity is greater than 0.04 ft/day (the updated ratio between modeled vertical and horizontal conductivity is greater than 1:25), the updated model shall be employed to re-run the scenarios, simulate the expected project impacts, and re-assess the impacts and their significance.

Project construction shall not commence until after CPM approval of the Aquifer Test Report and updated groundwater-flow model.

SOIL&WATER-9: The project owner shall monitor background and site groundwater levels in the Upper and Lower Aquifers. Monitoring shall include pre-construction, construction, and project operation water use. The primary objective for the monitoring is to establish pre-construction and project related water level trends that can be quantitatively compared against observed and simulated trends near the project pumping well, at the property boundary, and near potentially impacted existing wells. At least five (5) months prior to project construction, monitoring shall commence to establish pre-construction base-line conditions. The monitoring network shall be designed to meet the requirements described below.

A minimum of two wells shall be located off site and down gradient from the project water supply well; one well shall be screened only at depths corresponding to Upper Aquifer residential wells (average depth of 160 feet below land surface), and the other well shall be screened only at depths corresponding to the Lower Aquifer (450 to 600 feet). The wells shall be located sufficiently close to the proposed project site to be representative of local hydrogeologic conditions, but sufficiently distant from the project's water supply well to minimize drawdown effects from project pumping and nearby private wells. Similarly, a minimum of two wells shall be located off site and up gradient from the project water supply well; one well shall be screened only at depths corresponding to Upper Aquifer residential wells, and the other well shall be screened only at depths corresponding to the Lower Aquifer. The up-gradient wells shall be located sufficiently close to the proposed project site to represent local hydrogeologic conditions, but sufficiently distant to minimize drawdown effects from project pumping and nearby private wells. The distances to up- and down gradient wells shall be estimated and confirmed using the groundwater-flow model or an alternative quantitative method.

The above off site monitoring network can utilize either new dedicated monitoring wells, or existing inactive water-supply wells if existing wells are (a) readily accessible; (b) have construction information and borehole lithologic logs; (c) are deemed suitable to meet the stated monitoring objectives; and, (d) are oriented along an approximate groundwater flow line that passes near the project pumping well as determined by a map of contoured measured groundwater elevations or, if observed water level contours are not available, simulated elevation contours from the groundwater flow model.

In addition to the off-site monitoring well network, five monitoring wells shall be constructed on site; one monitoring well shall be located near the project water supply well, two wells shall be constructed near the up gradient property boundary, and two wells shall be constructed near the down gradient property boundary. Three of the five monitoring wells (the monitoring well located near the supply well, one of the up gradient wells, and one of the down gradient wells) shall all be screened to represent only depths corresponding to the Upper Aquifer. The remaining two up- and down gradient monitoring wells shall be screened to represent depths corresponding only to the Lower Aquifer. The site monitoring wells shall be oriented to fall along an approximate groundwater flow line that passes near the pumping well as determined by a map of contoured measured groundwater elevations or, if observed water level contours are not available, simulated elevation contours from the groundwater flow model.

Because subsurface conditions are spatially variable, all new monitoring wells shall be constructed in boreholes that intercept sufficient water bearing materials. The objective is to track water levels in the water bearing zones possibly accessed by local water supply wells, and boreholes that intercept predominantly fine-grained silts and clays are therefore unacceptable for monitoring well installation.

Water levels prior to construction, during construction, and for a minimum of one-year after the start of project operation shall be monitored at appropriate intervals using data loggers, installed in a manner that prevents vertical movement and drift over time (typically, data loggers are hung from a wire or cable secured at the wellhead). The pressure range of the data loggers shall account for the expected range in water levels. Vented data loggers are preferred to correct for barometric pressure changes. If site conditions require the use of non-vented data loggers, then a recording barometer located in the site area shall record barometric pressure to correct the non-vented data logger readings.

Initially, during the establishment of baseline conditions, water levels shall be recorded a minimum of twice a day corresponding in general to the average daily maximum and minimum air temperature. At least 30-days prior to the aquifer test required by **SOIL&WATER-8**, the data loggers shall record water levels hourly. Subsequent increases or decreases in the recording interval for pre-construction, construction, and project operations shall be based on observed temporal variability in the previously collected data. The recording interval shall be recommended as part of the monitoring data transmittal to the CPM described below and approved prior to construction.

Prior to and during project construction, the monitoring wells should be visited at least quarterly to download the data, service the data logger, and measure the depth to water using an electric sounder (the observed water level is used to confirm the data logger has not moved and drift is not occurring). More frequent site visits may be required depending on the recording interval and data logger storage capacity. A field sheet shall be completed during each site visit to record depth to water, data logger readings, battery condition, programming adjustments, and other relevant information.

Verification: The project owner shall complete the following:

1. At least seven (7) months prior to construction, a Water Level Monitoring Work Plan shall be submitted to the CPM for approval. The work plan shall include a scaled map showing the site and vicinity, existing well locations, and proposed monitoring locations (both existing wells and new monitoring wells proposed for construction). The map shall also include relevant natural and man-made features (existing and proposed as part of this project). The work plan also shall provide: (1) well construction information and borehole lithology for each existing well proposed for use as a monitoring well; (2) description of proposed drilling and well installation methods; (3) proposed monitoring well design; and, (4) schedule for completion of the work.

2. At least five (5) months prior to construction, a Well Monitoring Installation and Water Level Network Report shall be submitted to the CPM. The report shall include a scaled map showing the final monitoring well network. It shall document the drilling methods employed, provide individual well construction as-builds, borehole lithology recorded from the drill cuttings, well development, and well survey results. The well survey shall measure the location and elevation of the top of the well casing and reference point for all water level measurements, and shall include the coordinate system and datum for the survey measurements. Additionally, the report shall describe the water level monitoring equipment employed in the wells and document their deployment and use.

3. As part of monitoring well network development, all newly constructed monitoring wells shall be permitted and constructed consistent with County and State

specifications. The design, construction, permitting and reporting requirements shall be as specified in detail under **SOIL&WATER-7**.

4. At least 180-days prior to project construction, all water level monitoring data shall be provided to the CPM. The data transmittal shall include an assessment of pre-project water level trends, a summary of available climatic information (monthly average temperature and rainfall records from the nearest weather station), and a comparison and assessment of water level data relative to the assumptions and spatial trends simulated by the model. The transmittal can be included as part of the Aquifer Test Work Plan submitted as part of **SOIL&WATER-8**.

5. After project construction and during project operations, the project owner shall submit the monitoring data annually to the CPM as part of the Water Use Report required under **SOIL&WATER-6**. The summary shall document water level monitoring methods, the water level data, water level plots, and a comparison between pre- and post-project start-up water level trends. The report shall also include a summary of actual water use conditions and monthly climatic information (temperature and rainfall).

SOIL&WATER-10: The project owner shall take the following steps to assess potential well interference impacts to private well owners and to mitigate any such impacts. The project owner will identify and locate all active private water-supply wells within a three mile radius of the project. The well reconnaissance effort shall determine existing well construction, pumping rate, water use characteristics (required flow rate and storage capacity to meet seasonal water demand), and measured pre-project water levels.

After the model has been appropriately updated to reflect new information developed as part of **SOIL&WATER-8 and -9**, and the modifications approved by the project CPM, water level changes due to project pumping shall be simulated using the groundwater-flow model to confirm no significant impact to wells is anticipated. Water level changes shall also be monitored as required by **SOIL&WATER-9** and anticipated changes due to background conditions estimated empirically based on measured water level trends. If well owner's report interference problems to the CPM, and monitoring data provided by the project owner show these water level changes are different from background trends and caused by project pumping, the project owner shall provide mitigation to the well owner.

Mitigation shall be provided if the CPM's inspection of the well confirms changes to water levels and water level trends relative to measured pre-project water levels, and the well yield has been lowered by project pumping. The type and extent of mitigation shall be determined by the amount of water level decline and site specific well construction and water use characteristics. The mitigation of impacts will be determined as follows:

a. If project pumping has lowered water levels and increased pumping lifts, increased energy costs shall be calculated pursuant to **SOIL&WATER-11**.

Payment or reimbursement for the increased costs shall be provided at the option of the affected well owner.

b. If groundwater monitoring data collected as required by **SOIL&WATER-9** indicate project pumping has lowered water levels below the top of the well screen, and the well yield is shown to have decreased by 10-percent or more of the initial yield, compensation shall be provided for the diagnosis and maintenance to treat and remove encrustation from the well screen. Reimbursement shall be provided at an amount equal to the customary local cost of performing the necessary diagnosis and maintenance for well screen encrustation. Should well yield reductions be reoccurring, the project owner shall provide payment or reimbursement for either periodic maintenance throughout the life of the project or, if treatment is anticipated to be required more frequently than every 3-5 years, replacement of the well.

c. If project pumping has lowered water levels to significantly impact well yield or cause casing collapse, payment or reimbursement of an amount equal to the cost of deepening or replacing the well shall be provided to accommodate these effects. Payment or reimbursement shall be at an amount equal to the customary local cost of deepening the existing well or constructing a new well. The demand for water, which determines the required well yield, shall be determined on a per well basis using well owner interviews and field verification of property conditions and water requirements compiled as part of the pre-project well reconnaissance. Well yield shall be considered significantly impacted if it is incapable of meeting 150-percent of the well owner's maximum daily demand, dry-season demand, or annual demand – assuming the pre-project well yield documented by the initial well reconnaissance met or exceeded these yield levels. For already low-yielding wells identified prior to project construction, a reduction due solely to project pumping of 10-percent or more below the pre-project yield shall be considered a significant impact. The contribution of project pumping to observed decreases in observed well yield shall be determined using the groundwater monitoring data collected as required by **SOIL&WATER-9**.

The extent of impact and mitigation shall be subject to review and approval by the CPM. No later than 60 days prior to project operation, the project owner shall provide documentation showing that any mitigation to private well owners during project construction was satisfied based on the requirements of the property owner as determined by the CPM.

SOIL&WATER-11: Where it is determined that the project owner shall reimburse a private well owner for increased energy costs identified as a result of analysis performed in Condition of Certification **SOIL&WATER-10,** the project owner shall calculate the compensation owed to any owner of an impacted well as described below.

<u>Increased cost for energy</u>	= change in lift/total system head x total energy consumption x costs/unit of energy

Where:

change in lift (ft)	= calculated change in water level in the well resulting from project
total system head (ft)	= elevation head + discharge pressure head
elevation head (ft)	= difference in elevation between wellhead discharge pressure gauge and water level in well during pumping.
discharge pressure head (ft)	= pressure at wellhead discharge gauge (psi) X 2.31

- Any reimbursements (either lump sum or annual) to impacted well owners shall be only to those well owners whose wells were in service within six months of the Commission decision and within a 3-mile radius of the project site. These wells shall be identified as part of the pre-project well reconnaissance effort described under Condition of Certification **SOIL&WATER-10.**
- The project owner shall notify all owners of the impacted wells within one month of the CPM approval of the compensation analysis for increase energy costs.
- Compensation shall be provided on either a one-time lump-sum basis, or on an annual basis, as described below.

<u>Annual Compensation</u>: Compensation provided on an annual basis shall be calculated prospectively for each year by estimating energy costs that will be incurred to provide the additional lift required as a result of the project. With the permission of the impacted well owner, the project owner shall provide energy meters for each well or well field affected by the project. The impacted well owner to receive compensation must provide documentation of energy consumption in the form of meter readings or other verification of fuel consumption. For each year after the first year of operation, the project owner shall include an adjustment for any deviations between projected and actual energy costs for the previous calendar year.

<u>One-Time Lump-Sum Compensation</u>: Compensation provided on a one-time lump-sum basis shall be based on a well-interference analysis, assuming the maximum project-pumping rate of 20.8 AFY. Compensation associated with increased pumping lift for the life of the project shall be estimated as a lump sum payment using the following criterion:

- The current cost of energy to the affected party considering time of use or tiers of energy cost applicable to the party's billing of electricity from the utility providing electric service, or a reasonable equivalent if the party independently generates their electricity;

- An annual inflation factor for energy cost of 3%; and
- A net present value determination assuming a term of 30 years and a discount rate of 9%.

Verification: The verification for compensation required for increased lift shall be as follows:

1. No later than 30 days after CPM approval of the well drawdown analysis described in **SOIL&WATER-10**, the project owner shall submit to the CPM for review and approval all documentation and calculations describing necessary compensation for energy costs associated with additional lift requirements.

2. The project owner shall submit to the CPM all calculations, along with any letters signed by the well owners indicating agreement with the calculations, and the name and phone numbers of those well owners that do not agree with the calculations.

Compensation payments shall be made by March 31 of each year of project operation or, if lump-sum payment is selected, payment shall be made by March 31 following the first year of operation only. Within 30 days after compensation is paid, the project owner shall submit to the CPM a compliance report describing compensation for increased energy costs necessary to comply with the provisions of this condition.

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APPLICATION FOR CERTIFICATION FOR THE *CARRIZO ENERGY SOLAR FARM* PROJECT

Docket No. 07-AFC-8

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(Revised 7/27/2009)

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DECLARATION OF SERVICE

I, Hilarie Anderson, declare that on August 6,2009, I served and filed copies of the attached Draft Alternatives FSA Section, Draft Soil & Water FSA Section and Notice of Availability. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: **[http://www.energy.ca.gov/sitingcases/carrizo/index.html]**. The document has been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(C*heck all that Apply*)

For service to all other parties:

_x_ sent electronically to all email addresses on the Proof of Service list;

_x_ by personal delivery or by depositing in the United States mail at Sacramento, California with first-class postage thereon fully prepaid and addressed as provided on the Proof of Service list above to those addresses **NOT** marked "email preferred."

AND

For filing with the Energy Commission:

_x_ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below **(preferred method);**

OR

___ depositing in the mail an original and 12 paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
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I declare under penalty of perjury that the foregoing is true and correct.

Original Signature in Dockets
Hilarie Anderson

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